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# China Report

SCIENCE AND TECHNOLOGY

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12 JUNE 1986

## CHINA REPORT

### SCIENCE AND TECHNOLOGY

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## NATIONAL DEVELOPMENTS

### S&T OPERATING EXPENSE MANAGEMENT DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF S&T]  
in Chinese No 2, 1986 pp 31-33

[Article by Bai Mu [2672 2606], State Science and Technology Commission: "Some Facts About Reform of Management of Science Research Operating Expenses"]

[Text] According to the "CPC Central Committee Resolution Regarding Restructuring of the Science and Technology System," we must restructure science research operating expenses in order to strengthen overall management of science research operating expenses, give full play to the function of economic levers, promote the catering to society of research units, catering to building of the economy, rational and effective use of science research operating expenses, and the gain of even greater social and economic results.

I. We must unify responsibility for managing science research operating expenses.

With a central unified management of science research operating expenses and by linking operating expenses with research tasking and achieving overall control and balance we can achieve the following results:

1. From the view of overall management, we will break up the "common pot," and we will allocate and use science research operating expenses in accordance with the needs of the development of science and technology in this country.

Based on actual economic power in this country and on the development of future science and technology, there should be reasonable proportions and allocation of expenses for basic research, applications research, technology development, and dissemination of applications, as well as work on technical fundamentals, social benefits, and scientific and technical service. After a few years of adjustment, this should get progressively more reasonable. Funds allocation between departments ought to be based on our development strategies. Some should be enhanced, some should be decreased, and some should be maintained. We should change the "even handed" methods of the past, and with a few years of effort we can set up a science and technology system that suits the characteristics of this country. Effecting this sort of change cannot be done by any one particular department, for that would always be limited. It can only be done by all departments governing the full range of development of science and technology.

2. A unification of research operating funds with the management of research tasking.

Management of science research operating expenses will merge from purely financial management into the management of science and technology to become an important component of science and technology management. Linking tasking with funding will unify the management of funds and the management of scientific and technical tasking. From now on, higher level management departments will be selective in support, basing that support upon the amount of research tasking assumed by a research institute, the quality, the pricing, and length of time in order to create a situation of professional competition. With this transformation we will gradually eliminate the fragmented science and technology system situation in this country.

3. We will progressively change the nature of science research operating expenses, and will integrate them with the three expenses of science and technology into professional development funds, which will allow use of research operating funds to be more and more reasonable.

According to relevant papers and resolutions, using reduced operating funds to establish science and technology development funds that cater to professions, or to shift to science funds, and bring this together with the three expenses will form primary funding sources for departmental development of science and technology. This would be true even for units implementing responsibility systems. As reforms of the science and technology system develop, research operating expenses, the three expenses of science and technology, capital construction expenses, and technology transformation expenses should be combined for management, and setting up our own categories of science and technology management and giving full play to the function of economic levers will accelerate the development of our science and technology.

4. We will collect dispersed "small monies" into "large money," promoting the development of science and technology in this country.

The disparate nature of science and technology funding is a large defect in current scientific and technical management, and research expenses are even more so. Collecting "small monies" together into "big money": a portion of operating expenses reduced from each department each year; operating expenses that grow each year; use of small quantities of science and technology loans deducted from science research operating expenses. Combining these three portions together would provide a significant amount of science and technology expenses. The only way we can reach this point is by implementing centralized management of science and technology operating expenses. Otherwise, it cannot be done. The results of this collection of "small monies" into "big money" will be recognized by even more comrades after some years of effort and practice.

## II. Categorical Management of Science Research Structures

First, various categories of science research structures for science and technology activities of different characteristics are uniformly allocated

money on the basis of "head counts." There are 10,000 institutes eating from the nation's "public grain" in this kind of situation--apart from the large number of science research organizations independent of enterprises. No other country in the world has this situation. Due to limitations in the national financial capabilities, science research operating expenses allocated by the state each year are only enough for wages and daily expenditures, little is used as research expenses. Therefore, after research conditions in the vast majority of research institutes declined, research quality lessened, economic results were deficient, and most of the research was low quality repetition.

Second, only by orienting to society, to the basic levels, and to production, and by integrating with production can research units engaged in technology development generate achievements and produce economic results. And those research units engaged in basic research and applications research ought to be oriented to the world and to the front ranks of science research to develop those disciplines or fields that China ought to develop. For these things, to not practice categorical management would be to smother the energy in each category of research structure itself. A large number of science research organizations in technology development work that could find funding sources from various channels had no enthusiasm because of the "big pot" in research operating expense allocations, which affected basic research (the strengthening of which should have been stressed), applications research, and some general technical research, to the extent that the science and technology base in this country is rather weak.

It is our belief that when there is categorical management in keeping with the characteristics of the scientific and technical activities of research organizations the difficulties noted above can be overcome and avoided. At the same time as we encourage technology development to orient to society and implement technology contract systems, we should pay attention to strengthening applications research, as well as to providing stable and sustained development conditions for basic research. This will allow research work of all different types to have what they need and to develop in coordination.

Categorical management of science research organizations will in the first place bring guarantees of research funding; second, research directions will be clearer and more specific, avoiding blindness; and third, leadership energies will be more concentrated.

### III. How To Solve Problems in Funding Self-Sufficiency

We will progressively promote a technology contract system for work in technology development and for applications research from which we might expect near term practical value. Independent research organizations primarily engaged in this kind of work ought to obtain income and accumulate funds in the process of creating economic results for society through the means of contracting for projects in national planning, accepting commissioned research, transferring the rights to technical achievements, jointly funded development joint export operations, and consulting services. Operating expenses formerly allocated by the state will be progressively reduced, and we will work so that within the shortest possible time the majority among these



research organizations can be basically self-sufficient in operating expenses. The fundamental requirements by which these research organizations will practice self-sufficiency in operating expenses are:

First, in principle the state should no longer allocate operating expenses, which is the primary indication of operating expense self-sufficiency.

Second, under that premise, daily administration and business expenditures for each unit will be taken care of by each unit.

Third, implement a fixed asset depreciation and equipment renewal system. This is an excellent link for maintaining the economic activity of research units. If national assets are not discounted or are only "symbolically" discounted, then there will be no source for equipment renewal funds for research units and they will actually be taking part of national investments, and will certainly not be truly self-sufficient in operating expenses. In this way, the millions and even billions of yuan worth of fixed assets currently held by research units will be nearly completely consumed in less than 20 years, and there will be nothing from which to draw. Of course, for particular instruments and equipment for which investment is high and the rate of use is low, the renewal problems could be solved through the method of nationally subsidized secondary purchase expenses.

Fourth, take the responsibility for personnel training expenses.

It should be pointed out that after research units have become self-sufficient, they will not only be unlike the old sense of "research service," but will be different in nature from enterprises. Aside from the wages and benefits for departing and retiring personnel and training expenses for graduate students that should be allocated by the state, self-sufficient research units should not accept favorable circumstances from the state that the average enterprise cannot accept.

1. Enterprises must turn over various sorts of tax revenues in responsibility for social and public expenditures, and only under this premise can the profit and loss question be discussed, and the great majority of tax revenues from science research units (as for example for new products, transfer of rights to technology, and technical service fees) should be deferred or reduced.

2. In the use of funds, when enterprises use national fixed assets and circulating funds, that use is compensated. Moreover, capital construction funds needed in the future for enterprise expansion and reproduction will not be again funded by the state but will be changed to a system in which this is resolved by bank credit or by funds from the enterprises. Research unit current fixed asset and circulating capital may continue to be used for free. Future capital construction funds needed by research units for expansion should for the most part be invested by the state through methods of preferential support, and at the same time can also be handled through the methods of bank credit and privately raised funds.

3. Looking at it from the point of view of income sources, the income of enterprises is completely dependent upon commodity production and operations,

while income for research units is partially from technology reserve research projects, aside from a dependence on commodity operations (technical commodities and non-technical commodities), and they can also apply to the state for expense subsidies.

In summary, the distinctions between this type of research organization and enterprises correspond to the characteristics of research work and the needs of the national economy and of technology development, and this should be a long term policy for this nation. We should not see this as contemporary measures and expediciencies for the China of the present. We recommend that from now on when this country formulates relevant policies (as for example allocation policies, tax revenue policies, and credit policies), that we distinguish this type of research unit from general service units and enterprises. We do not want to say "they are all the same," and we neither want to treat this kind of unit the same as general service units, but also do not want to treat this kind of unit as if it were an enterprise.

We should explain problems in the significance of the phrases "self-sufficiency in funds," "funds independent," and "self-sufficiency in operating expenses." It is our belief that both "self-sufficiency in funds" and "funds independent" both indicate that expenditures of research units are handled by those units, and that there is no difference in concept between the two phrases. "Self-sufficiency in operating expenses" is a minimal requirement for "self-sufficiency in funds", for otherwise these research units cannot speak of attaining "self-sufficiency in funds."

#### IV. What is the Significance of Funds Responsibility?

It was pointed out in the "Resolution" that for research units engaged in socially beneficial service, such as medicine and hygiene, labor protection, family planning, disaster prevention, and environmental science, as well as those organizations engaged in scientific and technical services such as information, standards, measurements, and observation and in work on technology fundamentals, the state should still allocate funds, and that there should be funds responsibility. Operating expenses for organizations that disseminate and research agricultural technology would still be allocated by the state. We should encourage and support qualified units as they progressively reach self-sufficiency in operating expenses.

How shall we understand the significance of funds responsibility? At present, many comrades have explained it thusly:

First, the state should provide as much funds as are needed.

Second, taking 1985 as a base, this should grow annually.

Third, all expenses should come under funds responsibility, whether or not it is for information, standards, or measurements in that research organization.

There is a certain prejudice to each of these three concepts. The restructuring of the science and technology system itself is to break up the "big common pot" and to link up science research tasking with funds



management, and this principle is also suitable for units implementing funds responsibility. Essentially speaking, for these research organizations to implement funds responsibility is fundamentally the same as for units engaged in technology development to implement a technology contract system. This is because:

First, fund allocations are dependent upon the amount of responsibility assumed and the quality, and it is no longer a situation where either doing something or not or doing it well or not makes no difference.

Second, the guarantee is not complete. Tasking can be authorized and guarantees can be undertaken under the premises of pricing, duration, and quality, and in a similar way there can be competition. When the tasking undertaken has not been satisfied, the state will not be fully responsible for a portion of the people concerned. This will encourage them to orient to society and engage in all operations.

Third, aside from encouraging completion of tasking contracted from higher authorities, it will also encourage catering to society, carrying out technical services, and obtaining economic results.

Where this is different from the technology contract system is that the research achievements from these research organizations are needed by the state, but the majority cannot constitute technical commodities, no one will buy them at technology markets, but they should be purchased by the state. Therefore, when the state undertakes funds responsibility for this sort of research organization, these organizations will similarly be confronted with consolidation and restructuring, and some among them will join with enterprises or will combine internally within the system. They will also be confronted with the problems of "closure, suspension, merging, and retooling." For these reasons management of this sort of research organization should be undertaken according to the following methods:

1. Reevaluate the scope of service for the unit in question, determine groups and personnel and calculate a work index.
2. Implement funds responsibility according to the tasking that has been undertaken.
3. Appraise and decide upon operating expenses once, let what is saved be retained, and do not compensate overspending.
4. Take into account the annual work responsibility index, and in those cases where, for subjective reasons, the tasking was not completed, the following year's funds responsibility index should be adjusted.
5. Encourage qualified units (or work) to implement technology contract systems or fund systems.

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CSO: 4008/2090

## NATIONAL DEVELOPMENTS

### RESEARCH INSTITUTES GAIN TAX EXEMPTION

OW150005 Beijing XINHUA in English 1940 GMT 14 Apr 86

[Text] Beijing, 14 April (XINHUA)—Chinese research institutions will get a new incentive to transfer their knowledge and provide technological services as the Ministry of Finance has promised to reduce or exempt taxes on their activities.

According to a new tax rule made public today by the Ministry of Finance, the research institutions will be exempt from business tax and income tax on their earnings from technological transfer, offering technological services, training, contracting for technological development projects and exporting technology.

The product tax and the value added tax on the research and development of new products will be reduced for a fixed period of time and the amount of tax payments reduced are required to be used for technological developments, according to the new tax rules, which came into effect 1 April.

The research institutions are also encouraged to lease their idle instruments and equipment. The income derived from the leasing will be free from income tax if they are used to buy new equipment, the Ministry of Finance said.

To encourage research institutions to invest in energy projects and communications facilities and in development projects in old revolutionary base areas, regions inhabited by minority nationalities and border regions, the ministry said, the income tax on the returns of their investments will be cut by 50 percent within 5 years and, if they reinvest their earnings, the income tax will be exempt.

/12232

CSO: 4010/2017

12 June 1986

## NATIONAL DEVELOPMENTS

## TABLE OF PATENT APPLICATIONS BY COUNTRY

Beijing ZHONGGUO ZHUANLI [PATENT REVIEW IN CHINA] in Chinese No 1, 1986 p 16

[Text] Patent Applications from Major Countries and Hong Kong, October 1985

unit: individual item

Country or Region	Total (April-- October)	Total (this month)	Inven- tions	Functional New Model	Indus- trial Design	Non-job Related Inven- tion	Job Rela- ted Inven- tion
Japan	1,453	139	126	2	11	7	132
U.S.	972	116	113	1	2	4	112
West Germany	407	37	35	2		4	33
Netherlands	199	12	12			1	11
United Kingdom	168	6	6				6
Switzerland	132	8	8				8
France	114	11	11			1	10
Hong Kong	96	7	1	2	4	3	4
Italy	67	11	11			1	10
Australia	67	5	5				5
Sweden	58	8	8			2	6
Hungary	45	7	7			4	3
Austria	36	3	3			1	2
Canada	35	6	5		1	1	5
Denmark	30						
Belgium	22	1	1				1
Finland	15	1	1				1
USSR	5	1	1				1
Spain	2	1	1			1	
Others	76	6	5	1		2	4
Totals	3,999	386	360	8	18	32	354

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## NATIONAL DEVELOPMENTS

### SCIENCE, TECHNOLOGY MARKETS DISCUSSED

Lin Zongtang on S&T Conference

Tianjin JISHU SHICHANG BAO in Chinese 25 Mar 86 p 1

[Text] In the closing ceremonies of the recently convened All-China Technology Market Working Conference, Lin Zongtang [2651 1350 2768], Vice Minister of the State Science and Technology Commission and deputy group leader of the All China Technology Market Coordination and Guiding Small Group, made a summation report on "actively opening up technology markets and promoting enterprise technology advances."

Lin Zongtang said that technology markets are the product of restructuring, they are the creation of the masses, and they have a great vitality. They have created the conditions for restructuring of the science and technology system, and have strengthened the power and motivation for the self development of scientific and technical units; they have opened new paths for hastening the absorption, and assimilation of new ideas from imported new technology; they have accelerated the great diversion, great acceptance, and great improvement of our technical achievements, and have opened up a vast scope for the abilities of the broad mass of scientists and technicians; and we have powerfully motivated lateral integration of the economy and technology, and have powerfully accelerated the coordinated development of our economy. He said that technology markets are the bridge and link for the lateral joining of village and city, between production enterprises, and between production and research units, and that they will develop lateral economic amalgamations, which will be sure to greatly develop the technology markets. At the moment, our technology markets have developed sufficiently. For this reason we will maintain the principles of "opening up, invigorating, supporting, and guiding," will greatly increase development, will give a free hand, will explore many areas, and will exhaustively push the technology markets toward a new stage. In each sector and each region, all who are qualified will actively open up the technology markets, and at the same time will give autonomy to the technology markets to allow them to break through the fragmentation and truly give full play to the bridging function of lateral relations.

Comrade Lin Zongtang also said that in opening up the technology markets, adjusting organizational structures in the science and technology system, and encouraging the joining of research, educational, and design organizations with production units, the goal is to strengthen the capacity for technology



absorption and development, which will invigorate the economy and serve the four modernizations. Currently, economic development in this country needs to solve three problems: 1) production structures must be further adjusted to meet the needs of modernization of the national economy, improvement in the people's standards of consumption, and changes in consumption structures; 2) to resolutely shift the focus of construction to technical transformation and renovation and expansion of existing enterprises, and to go the way of internally stressed expansion and reproduction; 3) to correctly handle regional economic development relations, and spur the rationalization of regional economic distribution. To implement the tasks just described, we must greatly intensify the capacity of enterprises to absorb and develop technology. He also said that when technology is a commodity it is most important to sell it to enterprises. The development of technology markets ought also to proceed from the needs of the buyer, and we should organize technology trade well, wholeheartedly serve the technical advancement of enterprises, and serve the improvement of product quality, reductions in energy consumption, development of new products, and improvement in productivity.

When he was speaking about focusing on our economic construction needs during the period of the "7th 5-Year Plan" and the work that the technology markets should do, he said that we should pay close attention to the shift of foreign technology to the interior, the shift of coastal technology to the interior, the shift of urban technology to the countryside, and the shift of military technology to civilian use. We should coordinate well and energetically improve the capacity of enterprises for exporting and earning foreign exchange, and should especially greatly improve our capacities for exporting electromechanical production. We should develop lateral economic and technical relations, and improve social, economic, and technical results.

Comrade Lin Zongtang said that in opening up the technology markets and developing lateral economic relations, we must provide support from policies and provide protection with laws. We should adopt strong measures to urge the close integration of production with science and technology, and to spur on the combining of production enterprises with research units, in which research units would be primary or where production units could be primary, recruiting the participation of research units. Management departments of both parties should be actively encouraged and supported. Economically combined organizations will strengthen the capacity for technical development, through lateral amalgamation can absorb research units as their own development structures, can serve the technology development work of combined organizations, and can also permit them to serve other enterprises and units. Science research units joining in amalgamation can continue to enjoy the tax preferences for independent research units and there will be no increase or decrease in their operating expenses. We should actively support intermediate experiments in the amalgamation of production enterprises and research units, for which managing departments will make arrangements for in planning.

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CSO: 4008/2096

Song Jian on S&T Future

Tianjin JISHU SHICHANG BAO in Chinese 25 Mar 86 p 1

[Text] At the closing ceremonies of the recently held All-China Science and Technology Working Conference, State Science and Technology Minister in Charge Song Jian said that during the "7th 5-Year Plan" restructuring of the entire economic system a great framework will be established, that restructuring of the science and technology system will follow suit, and that technology markets should also get on track during the "7th 5-Year Plan." We will strengthen confidence, enhance management, be actively supportive, and run the technology markets well.

Comrade Song Jian also said that during the "7th 5-Year Plan," our scientific and technical front lines are facing changes in production structures and consumption structures. There will be advances in the technical transformation of existing enterprises, increases in the number of key science and technology projects, and meeting the challenge of the new world technology revolution will pose a large number of important topics for urgent resolution by science and technology. With completion of the tasking just described, and aside from a portion that will be organized and implemented through national planning, a great number of tasks will be realized through the bridges that are the technology markets. Comrade Song Jian also said that in opening up the technology markets we have come across a path by which to allow science and technology to rapidly transform into direct production forces. In this aspect, we will not yet have met the needs of economic construction and development. Therefore, we will strengthen confidence, and with an unflagging spirit will maintain and carry on in the direction of the commercialization of technology, for otherwise, the restructuring of our science and technology system will have no future.

Comrade Song Jian pointed out that it should be admitted there are still some problems in the technology markets, primarily in the fact that laws and regulations are not complete, the standards for laws and regulations are not clear, and the policies that should accompany development have not caught up. We will strengthen management, and will especially enhance building of the legal system. We will resolutely correct unhealthy tendencies existing in the technology markets, for otherwise our restructuring will falter and our technology markets will be destroyed. Those who violate the laws should be punished according to the law, but we cannot refrain from acting in fear of



failure just because individuals do wrong. He hoped that all areas and all departments pay special attention to this.

Comrade Song Jian concluded by saying that if the technology markets flourish and develop, that will prove that our enterprises are already depending upon science and technology, that they have the capability to absorb and assimilate science and technology. And it will also prove that our research organizations are catering to the economy and that they have shifted to the correct track of development. Then, our nation and our mission will take off for new heights from this point. Realization of this goal requires adoption of powerful support policies. Right now, comrades in finance, banking, and tax revenue departments are already actively studying and formulating policies to strongly support the opening and development of technology markets.

12586

CSO: 4008/2096

NATIONAL DEVELOPMENTS

LI PENG ON 'PROTECTIONIST' POLICY ON ELECTRONICS PRODUCTS

HK271500 Beijing ZHONGGUO XINWEN SHE in Chinese 1231 GMT 23 Jan 86

[Text] Beijing, 23 Jan (ZHONGGUO XINWEN SHE)--Vice Premier Li Peng said today, beginning with 1986, China's electronics industry will pursue an appropriate protectionist policy regarding its microcomputer and electronic parts products. All that can be produced in China which meet the requirements should be supplied domestically in the main.

Li Peng made this statement at the National Conference for Leading Cadres of the Electronics Industry which concluded this afternoon.

Li Peng said, China's electronics industry has, in recent years, imported a number of production lines for parts and microcomputers, which has played an active role in the development of the electronics industry. At present, China has already gone in for the production of 8- and 16-bit microcomputers in batches, and the production of electronic parts is up to certain standards. Therefore from now on, China should take itself as the base regarding those electronics products which China is capable of producing and the quality of which is guaranteed. In order to appropriately control imports, China is to pursue a protectionist policy regarding its electronics products.

According to him, marked accomplishments have been scored in the development of China's electronics industry. The gross output value of the electronics industry was 28 billion yuan in 1985, doubling the index of the annual plan, with a volume of 4 billion yuan in interest and taxes handed over to the state. From now on, the electronics industry should organize its forces to digest, absorb, and develop the imported technologies and to create something new with them, while incessantly improving our capability in design and development and upgrading the standards of China-made products.

/12858

CSO: 4008/1061

## NATIONAL DEVELOPMENTS

### SHAANXI PLANS TO DEVELOP ELECTRONICS INDUSTRY

HK240147 Xian Shaanxi Provincial Service in Mandarin 2300 GMT 17 Mar 86

[Text] The experts and professors who had come from inside and outside this province to attend the Shaanxi Study and Discussion Meeting on Invigorating Electronics pointed out: To readjust the arrangements for electronics, to develop economic relations among enterprises and regions, and to give full play to the advantages of technology and qualified personnel, is the necessary way to invigorate our province's electronics industry. In accordance with the views of the experts and professors, the meeting worked out a strategic program for invigorating the electronics industry in our province.

The strategic program points out: Although the electronics industry in our province has taken initial shape, the majority of the units are set up in mountainous areas. This has affected giving play to the advantages of the electronics industry. Therefore, during the Seventh 5-Year Plan period, the arrangements of the electronics industry in our province must be readjusted on a large scale. At the same time, the central authorities, provincial authorities, and enterprises concerned will invest 1.4 billion yuan to build three electronics industry cities in Xian, Xianyang, and Baoji.

The strategic program at the same time points out that to develop economic relations among enterprises and regions and to carry out management of the whole trade is the necessary policy decision to invigorate the electronics industry in our province. In the future, we must break the bounds of different departments, between departments and places, and of different places, and gradually form six large economic combines--television sets; electronic components and parts; semiconductor and microelectronic technology; computers; special communications equipment; and mould-making tools, and carry out specialized production and the management of the whole trade.

During the Seventh 5-Year Plan period, the annual gross value of the electronic industrial output of our province will reach 3 billion yuan and the amount of exports \$40 million. By the end of this century, the annual output value will reach 10 billion yuan. The electronics industry will become the first large industrial trade in the whole province.

The electronics industrial technology and qualified personnel in our province rank first in the whole country. During the Seventh 5-Year Plan period, in conjunction with the importing of technology and with reform of the scientific and technological structure, we must further give play to the advantages of technology and qualified personnel and gradually ensure that our electronic products are made by our country.

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## NATIONAL DEVELOPMENTS

### MEETING STRESSES DIGITAL DISPLAY TECHNOLOGY

OW201421 Beijing XINHUA Domestic Service in Chinese 1607 GMT 19 Apr 86

[By reporter Wang Yanrong]

[Excerpts] Beijing, 19 Apr (XINHUA)--When a digital display device is installed on a machine tool, the worker who operates the machine will not have to use a measuring instrument to measure the pieces the machine is processing and can easily and accurately determine the extent of processing work done. This reporter was able to observe this at the "on-the-spot meeting on remolding machine tools with digital display technology" held by the State Economic Commission and other departments at the 7 February Locomotive Plant under the Ministry of Railways today.

China has been engaged in studying and developing digital display technology for more than 10 years and has made relatively big progress in recent years. Those enterprises which adopted digital display technology all gained significant technical and economic benefits.

In order to promote the experience in remolding old machine tools with digital display technology, the National Office for Promoting Mechanical and Electronic Technology, the Equipment Management Office of the State Economic Commission, and the Beijing Municipal Economic Commission jointly sponsored the on-the-spot meeting.

Zhu Rongji, vice minister in charge of State Economic Commission, spoke at the meeting. He said: Using microcomputers and digital display devices to remold old machine tools is an important way to transform traditional equipment with new technology. It is technically reliable and has significant economic results. At the same time, it provides opportunity for using electronic technology and is conducive to the development of the electronics industry. This work is quite significant.

The 7 February Locomotive Plant, the No 1 Heavy Machinery Plant under the Ministry of Machine-Building Industry, and the Beijing Municipal Digital Display Technology Service Center introduced their experiences in promoting digital display technology at the meeting. Comrades concerned of 21 ministries and commissions under the State Council attended today's on-the-spot meeting.

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## NATIONAL DEVELOPMENTS

## SCIENCE, TECHNOLOGY SYSTEM CONTROLS DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF S&T]  
in Chinese No 2, 1986 pp 17-18

[Article by Huang Ze [7806 3419], Shanxi Provincial Science and Technology Commission: "On Control of the Science and Technology System"]

[Text] Control of the science and technology system has especially important significance for economic and social development, and problems in the following areas should be studied theoretically:

1. The laws of science and technology system structures, functions, and developments.
2. Science and technology management and the laws of the process of economic regulation of science and technology internal operations, among which are included the macroscopic black box method, the middle-view grey box method, and the microscopic white box method, allowing the integration in principle of self-regulation and self-organization in scientific and technical activities like strategies for scientific and technical development, scientific and technical forecasting, scientific and technical planning, changes in the allocation system, implementation of a compensated contract system, and the exploitation of technical fields.
3. Scientific and technical information, the processing and management of data, analysis and research, and retrieval services improve the creative capacity and research efficiency of scientists and technicians, and can as well reach the goal of controlling and strengthening system functions.

The structure of our national science and technology system is an irrational, hierarchical, multi-rung structure. If we allow science and technology to cater to building of the economy, that would be allowing this system to manifest a rational system structure through external control and by changes in the internal system, and to even more effectively implement its complement of functions.

When studying the control of science and technology systems, we should primarily concentrate on the management process. Macroscopically, we should focus on how this large system of science and technology adapts to the needs



of the economy and realize control of the science and technology system in the areas of strategy, policy, regulations, planning, and funding. We should coordinate the externals and internals of the system to accomplish a rational adjustment of the system structures and reach the goal of enhancing its functions. Microscopically, from the research institute to the topic group, emphasize the strengthening of science and technology and the economy through responsibility systems, technical contracts, and making the most of operational structures in the technology markets. Emphasize also the lateral relationships of social development, and invigorate the science and technology in a region, or a department, or a research unit to allow smooth implementation of the entire functions of the strengthened science and technology system.

There are the following aspects to the primary methods for science and technology system control:

### 1. Control of Science and Technology Policies

In order to suit the requirements of the coordinated development of our science and technology, economy, and society and the changing situation that is the new world technology revolution, current science and technology policies ought to study new science and technology system structures and science and technology internal operational structures, major investment directions for personnel and finance, and should selectively import and assimilate foreign advanced technology, hasten the dissemination and application of scientific and technical achievements, strongly develop knowledge, strengthen the management of science and technology, etc.

In substance, science and technology policies are a combination of both the economic and the scientific and technical, and they have a very strong controlling function in the science and technology system. Therefore, when studying the control of the science and technology system, we want first of all to study science and technology policies.

### 2. Control of Science and Technology Planning

In the old science and technology system, science and technology planning was an extremely important component in promoting the development of scientific and technical activities. It was just this sort of planning system that restricted the energy of the science and technology system and made research planning for research units depend upon higher levels, that made scientific and technical achievements depend upon the state for dissemination, that allowed research units to not care about competition in the marketplace, not care about renewal of commodities, and that allowed them to seriously lack the motivation to cater to building of the economy. In the new science and technology system, whether we want science and technology planning and how it would be planned are important aspects of controlling the science and technology system.

The key to restructuring the system of planning for science and technology is in changing the directive planning in science and technology system operations to focusing on planning that is guiding in nature. Under the new planning

system, aside from major planning projects of a strategic significance for the nation, the trend is for the functions of planning and regulation to progressively diminish, and in the areas of lateral relations in science and technology and the economy, the functions of technology market regulation and the requirements of a commodity economy will tend to strengthen, and this will generate a group of "short, level, and quick" projects that will be closely connected with local economies.

The emphasis when restructuring the science and technology system is on the correct integration of overall guidance and low level invigoration. In the situation in which overall guidance of science and technology is strengthened, the focus for restructuring planning should be placed on low level invigoration. This is because development of a commodity economy and the structures of an open economy demand that 90 percent and more of national scientific and technical capacity cater to the technical transformation of enterprises, cater to constant renewal of commodities, and cater to vigorous competition in international markets.

Our new science and technology system to a very great degree depends upon the ability of the new science and technology planning to control operations in the science and technology system. If we say that science and technology policies are the "software" with which to control this system, then the new science and technology planning is a portion of the "hardware" by which to control this system.

### 3. Control of Science and Technology Information

There is no end to scientific and technical information for scientific and technical fields today, and these days, when science and technology are developing so rapidly, there are about 14,000 papers published on an average day throughout the world that contain new knowledge. Each minute a new book is published, and an average of more than 100 patents come out each day. In the face of great quantities, overlapping, and rapid growth of scientific and technical information, scientists and technicians are always falling into the difficulties of not being able to find something, not being able to understand something, and not being able to finish reading something. Therefore, if work involving scientific and technical information is not done well, this will obstruct the improvement of research efficiency.

In the collection of information, analytical processing, retrieval, and editing belong to the internal control of information system functions; information selection service, backtrack retrieval service, and computer networks are under the external control of information system functions. Controllability of systems requires that the system be organized. Therefore, the control of scientific and technical information is the effective handling of the internal and external behavior of information systems. Strengthening the control of this kind of organized behavior is an important means by which to strengthen the control of information.

#### 4. Control of Science and Technology Legislation

If the science and technology system has only policy, planning, and information control, that will be neither complete nor full scale. We must add the coordination and restrictions from external environmental conditions before we can control the science and technology system in a full scale way. Science and technology legislation is the external environment and limiting condition under which the science and technology system can be assured of undertaking effective activities, it can accelerate the rapid application of scientific and technical achievements in everyday social life, especially in economic fields, and can prevent the generation of harmful consequences. The relations generated between the development of science and technology in the developed countries of the United States, Japan, the Soviet Union, and West Germany and the regulation of scientific and technical activities have to a great degree relied upon science and technology legislation for implementation. Therefore, to realize effective control of the science and technology system in our country we must strengthen our work on science and technology legislation.

There are still many problems in this country in the area of science and technology legislation, as well as many gaps, and we must systematize science and technology legislation as quickly as possible.

Perfection of science and technology legislation will allow the strengthening of control over the science and technology system, and will allow for more coordination in the development of science and technology, the economy, and society.

In sum, control of the aspects of policy, planning, information, and legislation are interacting at the same time in the science and technology system, and it is they that accomplish the goal of control.

Control of the science and technology system is the same as control of any other system, that is, we want to maintain system operations within specific allowable limits. More broadly, there are two goals for control:

1. Controlling changes in the system and maintaining the stability of the system.
2. Accelerating changes in the system and reaching a new anticipated state.

However, for the old stable state to undergo changes and reach a new stable state is not an easy matter. Therefore, there will be an evolutionary process, and if there is new overall control and everything is done at once, then when the new stable state is reached it is certain to create omissions in control, and there will be difficulties for the rational adjustment of system structures and for the joining in control of the coordination, overall view, middle view, and low level view of system internal operational structures. This is because new states cannot completely eradicate older states, but can only progressively fulfill and enrich itself in the process of disintegration of the old state in accordance with the overall requirements and directions of the new state, finally reaching a new stable state. In the situation of this

transition stage or when the new and old states exist concurrently, the following three problems should be well considered:

First, is the perfection of the new control measures. The new control methods and measures are the principles, measures, and guarantees by which the science and technology system goes from one state to another. However, in the change that realizes a system state, new control measures are certainly not perfect nor mature, and some are exploratory. Therefore, we should pay close attention to the study of new method and measures, and should avoid occurrence whereby old control methods become ineffective and where new control methods are largely blind. That would cause disturbances of ineffectiveness in the system, and would waste time, personnel, and finances.

Second, is centralized control and dispersed control. Having centralized control and dispersed control is a principle in control theory. It is a hierarchical principle for controlling and using a large system. Our national science and technology system is highly organized, there is much multilevel management, i.e., the often mentioned five front armies, while local systems are also divided into science and technology commission systems, various office systems, and local enterprise systems. Were there not the aspect of hierarchical control, there would be a blockage of information with wrangling between levels, while creating a situation of control imbalance and confusion. In a rationally organized hierarchical control system, each portion controlled by another level is a unified entity to execute a particular function. It is also coordinated uniformly in its behavior by its own controlling goals and by the overall goals of the system. Therefore, we must have hierarchical control at different levels. Without that, there would be no objective control. As for example when in the past we said "things die as soon as they are controlled, and things get confused as soon as control is released." Therefore, under the requirements of the overall goals and overall principles for the overall control of the entire science and technology system, we want to be sure to do a good job when studying hierarchical control and make overall, middle level, and lower level control coincide.

Third, is the evaluation of control results. Evaluation of the results of controls is the determination of the degree of control in this system, but it is not a question of using a mathematical model to solve for the optimization of science and technology system control. How shall we evaluate the results of system control? Science and technology system control results should be the economic and social results generated by manpower, material power, and financial power functioning under determined control measures and methods within a certain time.

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CSO: 4008/2089



## NATIONAL DEVELOPMENTS

### BEIJING TECHNOLOGY IMPORT STATISTICS REPORTED

Beijing BEIJING KEJIBAO in Chinese 26 Feb 86 p 1

[Report by Chen Zhiqiang [7115 1807 1730]: "Technology Importation In This City Is Developing Rapidly"]

[Text] Reporters have learned from the technology transformation working conference held recently in Beijing that the scale and depth of technology importation in this city in 1985 once again had new development. A total of 325 deals were reached with foreign interests for a total financial volume of \$320 million. This surpassed that of 1984, which had been the highest volume in history. At the same time, this city also won seven support projects from the United Nations development support office, for a total volume of \$9.8 million.

Last year, among the 325 technology importation projects in this city, 149 (45.8 percent) involved standards of the 1980's and 176 (54.2 percent) involved standards of the 1970's. For example, among those with advanced standards were intelligent instrumentation technology, helium-neon laser devices, nuclear magnetic resonance spectrometers, graphics facsimile machines, optic fiber production equipment, and optic fiber external waveguide production technology.

Among technology importation work in this city last year, the focus was on complete sets of equipment for the goal of domestic production. Fourteen projects (total transaction amount of \$15.45 million) were contracted for by the municipal broadcast television industry general companies and 9 projects were key components in manufacture technology imported for the domestic production of color televisions (a total transaction volume of \$13.24 million), which accounted for 85 percent of the total volume. To better improve the domestic production process for refrigerators and washing machines, this city imported temperature controller and evaporator manufacturing technology, as well as equipment for washing machine plastic injection molding.

Among the technologies imported last year, this city continued to stress support of industries of preferential development. There were 35 transactions regarding food product transactions (total transactions of \$35.18 million), 11 percent of the total transactions. There were 41 projects for the electronics

and precision instrumentation industries at \$47.73 million, or 14.9 percent. There was a great increase in transactions for the building materials industry, contracting for 18 projects altogether for \$26.26 million, or 8.2 percent. This was double that of last year. There were 96 projects for the textile industry (a volume of \$60.36 million) for 18.8 percent. The motor vehicle industry had 18 projects for \$19.09 million and 6 percent. At the same time, attention was also paid to arranging for technology importation for the raw materials industries.

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## NATIONAL DEVELOPMENTS

### S&T PERSONNEL ENCOURAGED TO HOLD 'SPARE TIME' JOBS

#### Questions, Answers

Shanghai WEN HUI BAO in Chinese 12 Mar 86 p 1

[Interview with Liu Zhenyuan, deputy mayor, Shanghai Municipality by Yao Shihuang [1202 6108 3552] and Fudan University journalism department trainee, Zhang Wan [4545 4111]: "How Shall We Regard Concurrent Spare Time Jobs for Scientists and Technicians?"; at Shanghai Academic Conference on Technology Markets, 11 Mar 86]

[Text] Deputy Mayor Liu Zhenyuan [0491 2182 0337], who attended the Shanghai Academic Conference on Technology Markets, responded yesterday morning to reporter's questions on the problem of concurrent spare time jobs for scientists and technicians.

Question: "At the moment, there have been some disturbances regarding the question of concurrent spare time jobs for scientists and technicians. Could we hear your views on this question?"

Answer: "On this question of concurrent spare time jobs for scientists and technicians we still go on the basis of the resolution of the CPC Central Committee regarding restructuring of the science and technology system: when they do not violate the rights of the host unit nor affect the current job, we should permit concurrent jobs for scientists and technicians in their spare time. Of course, we must strengthen our leadership and management to an appropriate degree. This is because, on the one hand, an individual's abilities and energies are always limited. To be a unit leader and be worried about staff having another job, about a dispersion of energy, about it affecting the main job, these concerns can be understood. Therefore, we must strengthen leadership at the first job, there must be indices for amount of work done, and there must be accounting. Concurrent work must also be moderate. However, because intellectuals are currently not numerous, if we are to make full use of their enthusiasm we should permit scientists and technicians to have concurrent jobs in their spare time. We should clearly differentiate "on the job" from "outside the job," and if scientists and technicians are employed in their spare time, engaged in intellectual activity, then they ought to be permitted autonomy."

Question: "At the moment, some units are investigating the income for scientists and technicians from spare time work, and some people have been evaluated as advanced but have been held back. How should this be dealt with?"

Answer: "When scientists and technicians engage in spare time work, they receive a certain compensation for their labors, which is permissible and legal. If there are unhealthy practices going on, then of course they should be investigated. But we cannot see legal income from spare time work as being from unhealthy practices, or see it as ill-gotten wealth. If there are unhealthy practices in the process of engaging in spare time work, these should be investigated and corrected."

Question: "When scientists and technicians engage in spare time consulting activities, how can we distinguish "organization" from "self"?"

Answer: "After studying this we feel that any consulting activity for organizations like the science association, professional associations, and staff technology associations should be labeled as organizational, and for scientists and technicians to take part in this sort of consulting activity is not self-employment."

When reporters asked finally about how the municipal government is going to enhance leadership and management in regard to spare time employment, Liu Zhenyuan said, "We have already decided that on the basis of provisional measures drawn up by relevant departments, municipal government regulations on consulting will be formulated and published as soon as possible based on rather complete provisions and methods drawn up after study of relevant aspects."

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### Laws, Provisions Described

Beijing GUANGMING RIBAO in Chinese 23 Mar 86 p 1

[Text] In the current rectification of unhealthy tendencies, some units have opposed the legitimate remuneration earned by scientists and technicians at jobs in their spare time. For example, some have made internal investigations about or transferred scientists and technicians who in the first phase had extra jobs or participated in consulting activities; some have confiscated the income of scientists and technicians from these jobs; some have wanted party members to clarify this question during party rectification, or otherwise they would not approve of their membership; some have even aroused the masses to "expose the problem." All of these actions are wrong.

The "Resolution by the CPC Central Committee Regarding Restructuring of the Science and Technology System" has already clearly ruled on this question of spare time jobs for scientists and technicians: "Under the prerequisite that they must complete the work of their primary jobs and that they cannot violate the technical rights or the economic results of the host unit, scientific and technical personnel may engage in technical work and consulting services in their spare time, and may retain the income thereof; the unit must agree if they are to use technical achievements, internal technical materials, or equipment that belongs to the host unit, and a portion of the income should be turned over as well." When scientists and technicians have not violated the provisions just described, engaging in spare time work activities is appropriate and legal. Their legal right to this ought to be protected, and if they make outstanding contributions in that spare time work activity, they should make the same kind of outstanding contributions in their primary work, should be commended, and should not be censured, or attacked, without reason.

Spare time work for scientists and technicians is an effective method by which to make up for the insufficient numbers of scientists and technicians as we restructure the economic system and in this situation where science and technology is so urgently needed in all areas. The social and economic results that they bring along are very obvious. First, they have promoted lateral economic relations and have improved the capabilities for technology development and transformation in enterprises, and have especially made beneficial contributions to the development of township and town enterprises. Second, they have promoted the integration of science research with production. Scientists and technicians with concurrent work have opened up

the two way flow of information between production and science research, they have rapidly brought technology into production and have also fed back production problems and market information into the research institutes. They have enriched the substance of science research and have even created new research topics. Consequently, this has allowed research units to strengthen their economic, marketplace, and process outlooks. And this is an important matter for the restructuring of the science and technology system. Third, they have aided the exchange of knowledge, they have expanded the fields of knowledge of scientists and technicians, have urged the catering to production by scientists and technicians, and they have moved in the directions of society. Consequently, they have trained a group of scientific and technical talent that understands science and technology, understands the economy, understands laws and regulations, and understands the all-around development of trade. We should accurately evaluate spare time jobs for scientists and technicians in light of these positive factors, and should not look only at what is under our noses. Even less should we look enviously at the "money" they can make. It must be known that the money they make is obtained from labor, and that the money they make is only a small portion of the value they have created.

Admittedly, a minority of people in spare time work activities are only there for the money, that work affects their primary jobs, and they have even violated the law and committed crimes. However, this is in fact nonessential. Those who after investigation are truly criminals should be dealt with legally and punished according to the law; those who have affected their primary jobs should be reeducated. Just because a very few people have caused some problems, we should certainly not close the doors and refrain from doing necessary things in fear of the risks. There is no need for reticence. Where there are shortcomings in the particular regulations for these areas, with a positive attitude we should supplement and perfect them by earnestly summing up our experiences on the basis of actual practice. We should not analytically adopt "blocking" measures, even to the extent of labeling them as "unhealthy practices," for this would be harmful to the restructuring, to the economy, and to the development of science and technology.

Naturally, as far as the scientists and technicians taking part in spare time work activities are concerned, we want to pay attention to handling well the relations between the primary job and the spare time job. They must respect national laws and relevant policies and provisions and make their stand with even greater contributions to the state and to society, and should not think too much of what the individual has to gain or lose.

12586

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### S&T Laws Become Necessary

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF S&T]  
in Chinese No 2, 1986 p 36

[Article by Yu Renbo [0060 0088 0130], Shandong Provincial Science and Technology Commission: "We Should Support Scientists and Technicians in Using Spare Time for Concurrent Positions"]

[Text] Not long ago an official of the State Science and Technology Commission pointed out on a visit to Shandong that we hope that each person can do as much as he can, as little as that may be. As long as we are willing to make the most of what we have we will provide encouragement in the form of policy. To solve this problem, we should permit and encourage concurrent jobs in spare time. In Hungary you can work as long as you have spare time, and moreover this is beneficial to the state and to the people. It shows that when you have made contributions above and beyond your regular work, what you are doing will have economic results. This is a good thing by which to enrich the country and benefit the people. Why should we not support this? We should try to make the most of the potential of people's spare time. As long as everyone on the soil of this socialist country is able to create more wealth, this is good for our state, our people, and our mission, so it ought to be permitted, supported, and encouraged.

According to statistics from the State Science and Technology Commission, among current scientists and technicians, only about 20 percent can make the most of their functions, 10 percent basically make nothing of their functions, and 60-70 percent of manual labor is done at a half load, definitely not fulfilling. Spare time jobs help make the most of the potential of scientists and technicians, they free scientists and technicians from the existing system, and give full play to the positive roles they have not yet completely fulfilled. This is just what is so urgently needed to invigorate our economy and our scientific and technical mission. Even so, there is a current strange phenomenon: in leisure time people are playing poker, chess, and fishing . . . No one is finding fault or censuring this, but when people use their spare time to take on some proper work, and go to enterprises to help with ideas and to change the backward situations there, for which they are rewarded, then everyone starts talking and this is seen as a great outrage. Even discovering or inventing something in spare time or transferring the rights to some technology, is even more considered "doing something for one's self," "not



being involved in proper work," and "only thinking about money," and similarly people cannot help but be bitterly ironic and disdainful.

It would seem that those engaged in farming and commerce can get rich first through their own outstanding efforts, and that only intellectual laborers ought to get rid of this policy. Since scientific and technical labor is also labor, and what is more is a complex intellectual labor, of even greater value created for society, so why can it not be rewarded even more? More for more labor is a socialist principle of allocation, so why is use of spare time to make contributions to the state and people actually viewed as illegal? This is surely an appearance of a remnant of "leftist" thinking.

The ways in which to make more contributions to society may be various and diverse. When scientists and technicians work in their spare time and obtain compensation for doing so, all to improve their lives and teaching and research conditions, they should do so with justice on their side. An ideal communist education is necessary, but we cannot on that basis deny the allocation for labor principle at this current socialist stage; if we were to proceed from the absolute egalitarianism of the small producers, which censures getting more from more labor, that attitude is true blasphemy of the principle of allocation according to labor, and the consequence of that can only be injury to the socialist system! Marx and Engels had already discussed this fully in the "Manifesto of the Communist Party" as something we should guard against and oppose.

Actually, the great majority of our scientists and technicians enjoy life and have no extravagant wishes, and what most concerns them is their hope that they can work more, contribute more effort, and have their own labors truly bring economic results. Therefore, questions relevant to jobs in spare time must be earnestly studied and satisfactorily resolved to guarantee that scientists and technicians will be able to fulfill their functions. One important point at present is that we want to perfect an accounting index for the primary job to scientifically determine the amounts of work. In the past, because we have been accustomed to eating from the common pot, there is no fixed amount of work, nor any way to account for it, for everything is "dependent upon conscience." Under these conditions, some leaders have been concerned that jobs in spare time would be a blow against work at the regular job, which is natural. The key is that there is no scientific accounting. Scientists and technicians have ideas on this, too. If there were a scientific and rational accounting index, actual practice has shown that jobs in spare time can accelerate and spur on advancements in management.

At the same time, setting up rules and regulations for science and technology that guarantee various matters concerned with the jobs of scientists and technicians in spare time are very important. Because those rules and regulations are currently lacking, some scientists and technicians who have made contributions and gained some income are often imprisoned mistakenly as "economic criminals." This shows that setting up and perfecting science and technology laws is already so very necessary and urgent!

Of course, in the labor of jobs in spare time we must stress that we cannot transgress the technology rights of the unit. Therefore, we should pay close

attention to what goes along with any reform and we must proceed in step so that we better eliminate obstacles that affect the development of production. And to the greatest degree should make the most of the potential of scientists and technicians to accelerate the closer integration of science and technology with the economy.

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CSO: 4008/2090

## NATIONAL DEVELOPMENTS

### SHANGHAI S&T MARKET ACTIVITY DESCRIBED

Shanghai WEN HUI BAO in Chinese 11 Mar 86 p 1

[Report by Yao Shihuang [1202 6108 3552]: "Shanghai Technology Markets Are Prosperous with Large Economic Results"]

[Text] In the year since the CPC Central Committee decided to propose the "opening up of technology markets" in regard to the restructuring of the science and technology system, technology markets in Shanghai have developed rapidly to become an important link in changing the operational system of science and technology. In 1985, the trade volume in technology markets throughout the city reached 580 million yuan, more than a fourfold increase over the previous year.

The opening of the technology markets has aroused an inner vitality for the catering to society of research units that concentrate on developmental research, it has strengthened relations between research units and production departments, and has stepped up research into difficulties of production technology. The dissemination rate for technical achievements in this country has improved from about 20 percent in 1979 to more than 60 percent at present. According to statistics for the 5,380 achievements obtained during the "Sixth 5-Year Plan," 3,747 have already been applied at an application rate of 69.5 percent. The national defense science and industry system, which in the past has had few contacts with civilian departments, has signed more than 3,800 contracts, agreements, and letters of intention, they have formed 48 production lines for major civilian products and make 57 staple commodities, for an average yearly output value of more than 1.5 billion yuan.

The economic and social results obtained after opening the technology markets have been completely obvious. After the Shanghai Petrochemical Plant and Polyester Fiber Plant obtained information on relevant energy saving technology, they took the initiative to commission the Shanghai Institute of Marine Diesel Engines to develop an exhaust gas energy recovery and electricity generation package. After this energy conservation package went into use (the first of its kind developed in this country), it generated 3.68 million kWh annually, which can increase output values by 18 million yuan.

Through the technology markets, research units have strengthened their actual and motive powers for self development, and have created the preconditions for

restructuring of the science and technology allocation system. Through various technology trade affairs, science research units have had an obvious improvement in economic income. By the end of 1985, there were already 19 local research institutes in this city that were economically independent, 12 had reached two-thirds independence, and 26 had reached one-third or more economic independence.

Invigoration of the technology markets has further aroused the enthusiasm of scientific and technical personnel. According to a 1985 sampling survey of 3,714 middle aged scientists and technicians, 25.8 percent felt that they were able to completely fulfill their function, which is double that of a 1983 survey; 7 percent felt that they could not fulfill a function, which is a two-thirds drop from 1983. With the understanding that they complete their main job first, many scientists and technicians also give full play to their "surplus enthusiasm" and actively take on after-hours consulting services, becoming an important force in invigoration of technology markets. Last year alone, the city science association sent more than 400 consulting delegations to 23 provinces and cities throughout the country, a total of more than 3,000 people.

To further solidify, perfect, and develop the technology markets in Shanghai, the municipal science and technology commission will continue to explore problems in the areas of the nature, function, modes of development, and policy of technology markets, as well as the pricing of technical commodities, at the academic conference on technology markets now being held. They will also propose and draft suggestions for relevant measures and methods regarding the perfection of the management of technology markets in order to bring about greater prosperity for the Shanghai technology markets.

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CSO: 4008/2091

## NATIONAL DEVELOPMENTS

### PATENT LITIGATION PROCESS DESCRIBED

Beijing ZHONGGUO ZHUANLI [PATENT REVIEW IN CHINA] in Chinese No 1, 1986  
pp 22-24

[Article by Fei Zonghui [6316 1350 5966]: "On the Patent Litigation Process in China"]

[Text] Based on the provisions of the "Rules of Organization for the People's Court of the People's Republic of China," the People's Court system in this country includes various levels of local people's courts, special people's courts, and the supreme people's court.

There are no criminal courts, civil courts, or economic courts at any level of the local courts or at the supreme court, but they each try criminal, civil, and economic disputes and cases. The people's courts try cases through a system where the court of the second instance is the court of the last instance. When the litigant or defendant refuses to accept the first verdict or ruling from any level of the local people's court, he has the right to lodge an appeal with the next higher level of the people's courts. When a local level people's investigation court holds that the first verdict or ruling was in error, the wronged party may then contest the original verdict or ruling at the next higher people's court. The second verdict or ruling that is made by the next higher people's court is the final verdict or ruling, that is, the verdict or ruling will have taken legal effect and the litigant cannot again bring the case to court. However, if the presiding judge at any level of the people's courts discovers definite errors in what has been held to be factual or legal where a verdict or ruling of the court in question has gone into legal effect, he must submit this to the trial commission of the court in question for discussion to determine a new trial (retrial). Upon discovery of definite errors, the supreme court, in regard to verdicts or rulings that have gone into legal effect from any level of the people's courts, or a higher court, in regard to verdicts or rulings that have gone into legal effect from a lower level of the people's courts, has the authority to hear the case or to instruct a lower court to conduct a retrial.

China has not established specialty courts for the trial of trademark or patent cases. Trademark and patent disputes and cases and relevant criminal cases involving trademarks or patents are tried according to procedures provided for in the "PRC Civil Procedural Laws (provisional)" and the "PRC



Criminal Procedural Laws," respectively, in economic and criminal courts of the ordinary people's courts.

Based on provisions of the "PRC Patent Law" and "Detailed Rules and Regulations for the Implementation of Patent Law," the following seven kinds of patent disputes and cases are accepted and heard by economic courts of the people's courts: 1. a case of suit in the people's courts when an applicant for an invention patent does not accept the decision by the patent review commission in which it has turned down his request for review; 2. a case of suit in the people's courts when a dissenter or patent right holder does not accept the decision of the patent review commission in proclaiming that a patent for invention is not valid or that it upholds the rights to an invention patent; 3. a case of suit in the people's courts when a patent holder does not accept the decision by the patent office regarding implementation of compulsory compliance; 4. a case of suit in the people's courts when a patent holder does not accept the ruling of the patent office regarding the fee for use in implementation of compulsory compliance; 5. a dispute or case regarding the expenses for using an invention, a functional new model, or industrial design after application for a patent has been announced but before the patent rights have been granted; 6. a dispute or case involving violation of patent rights; 7. a dispute or case involving transfer of the application rights to a patent or a patent rights contract.

Patent cases are very specialized and international in nature, and jurisdiction is appropriately centered on a few courts. This is of advantage to ensuring unity in applicable laws, it is of advantage in summing up experiences from decisions, and it is of advantage in ensuring the quality and continuing improvement of handling cases. Proceeding from the actual conditions in this country, the supreme court has determined that jurisdiction over patent cases shall be divided as follows: 1. for all disputes and cases for which suit has been brought due to refusal to accept verdicts or rulings of the State Patent Office or the patent review commission, those disputes and cases regarding whether or not to grant invention patent rights, regarding proclamation that a conferred invention patent right is invalid or that it is upheld, or regarding patent implementation of forced compliance and the expenses for forced compliance, the Beijing Municipal central level people's court, being the location of the State Patent Office and the patent review commission, is the first court and the Beijing Municipal level people's court is the second court. 2. For disputes and cases regarding patent violations, regarding expenses for use of an invention, functional models, or industrial design after announcement of application for patent and before the patent has been granted, as well as disputes and cases regarding transfer of the rights to patent applications or contracts for patent authority, the first court is the middle level people's court in the locations of the provincial, or autonomous region, or directly controlled municipality people's governments and the middle level people's courts for each special economic zone, and the high level people's courts of the province, autonomous region, and directly controlled municipality are the second courts. Based on actual needs, the provincial and autonomous region high level people's court can instruct, with the concurrence of the supreme people's court, middle level people's courts of

open cities in the province or autonomous region in question or of large cities that have no patent management to act as the first court for trying the third type of case within districts under their jurisdiction.

In consideration of the fact that patent trials are work that is a close integration of science and technology with the law, the supreme court has already indicated that all high and middle level people's courts taking on patent trials will select, according to actual needs, a number of trial personnel with scientific backgrounds and who understand foreign languages to be responsible for work in patent trials. With an eye to the future, we must also train in a planned way a group of specialist judges to take on this work who both understand the law and also understand technology. Our patent system has just been established, and patent trials are in their initial stages. In the near term, we should also use and hire technical specialists to hold jobs as the people's jurors at trials, or to be employed as temporary or long term technical advisors to provide consultation, or to be employed as technical appraisers for solving technical problems during trials.

Foreigners, stateless people, and foreign enterprises and organizations suing, answering suits, or complying with laws and regulations in our people's courts share equal rights and duties regarding litigation with citizens and enterprise organizations of the PRC, and they may authorize one or two people to represent them in court; if they authorize a lawyer to represent the case, they must commission PRC patent lawyers. Representatives who are so commissioned must submit letters of authorization to the people's courts, and the letters of authorization must clearly state the affair authorized and the authority. If it is necessary to commission a legal representative to plead guilty on one's behalf or to not contest the suit, or for necessary litigation requests, for arbitration, for countersuits, or for appeals, then there must be special authorization. Letters of authorization sent to Chinese lawyers or Chinese citizens from foreigners or stateless people not living within the PRC, or foreign enterprises or organizations with which the PRC has not established resident representative organizations, must be certified by a notary organization of that country, and must be certified by a Chinese embassy or consulate in that country before it can be valid.

In the trial process for patent disputes or cases, the litigant has the responsibility to provide evidence on behalf of the stand he has taken, and the people's courts, too, should in a full scale and objective manner collect and investigate evidence in accordance with legal procedures. For example, in the stage of preparation before the trial comes to court, judicial personnel must diligently examine the litigation materials, including the evidence provided by both parties to the litigation, and then investigate and study it, and collect evidence. As the trial begins, judicial personnel should carry out the court investigations according to the following sequence: 1. question the parties to the litigation and statements by them; 2. question witnesses and read out the evidence of witnesses who are not at the trial; 3. question judges and read out judges' conclusions; 4. produce documents, material evidence, and what can be seen and heard; 5. read out investigator's notes. The litigants may present new evidence in court; with the court's permission, litigants may examine witnesses, judges, and investigators; they may request reappraisal, reexamination, or reinvestigation, but whether or not that is

granted is up to the people's court. At the conclusion of the court investigation, have a debate in court. When the court debate has concluded, the presiding judge will seek the final opinions from both parties, first from the plaintiff, then from the accused, and finally will reach a decision in accordance with law. The verdict announced by the court will be public throughout. When the court has announced its decision, the written judgement should be available within 10 days; judgement pronounced at a fixed time should be immediately available as written. For patent infringement disputes and cases, disputes and cases concerning expenses for use of inventions, functional new models, and industrial design after announcement of patent application but before granting of patent rights, as well as disputes and cases regarding transfer of rights to patent applications or contracts for patent rights, at each stage of the trial the people's courts ought to implement principles that emphasize mediation. On the basis of clarifying facts and distinguishing right and wrong, they should urge litigants to understand one another and to reach an agreement. Judgments should be timely when mediation is not effective.

When proclaiming that conferred patent rights are invalid, first of all the patent review commission should undertake an investigation so that during the process of litigation over patent infringement, when a defendant countersues for invalidation of patent rights, the people's court hearing the patent infringement case should notify the defendant in accordance with the provisions of patent law and should apply to the patent review commission for a review. If still refusing to accept the review decision, the complainant may begin litigation in the middle people's court of Beijing Municipality. During this time, the people's court hearing the patent infringement litigation may stop the litigation and wait until the problem of whether the patent rights are valid or not has been decided before returning to the patent litigation.

In patent infringement litigation, the people's courts may instruct the defendant to stop patent infringement behavior based on application by the plaintiff or according to a ruling by authorities for the preservation of the litigation, and may as well adopt the litigation preservation measures of sealing up, distraining, freezing, and requiring provision of security. When the people's court decides to adopt litigation preservation measures and instructs the defendant to stop patent violation behavior, it may, due to necessity, instruct the plaintiff to provide security, and if he refuses to do so may reject the application. When the applicant has sued in vain, he should compensate the defendant for the loss of property caused by litigation security. Of course, the people's court will be very circumspect in its adoption of litigation security. They will not be easily used unless the facts regarding violation are very clear, the situation is very urgent, or the plaintiff has provided irrefutable evidence and there is every assurance he will win the case.

Patent law in this country provides that the effective period for litigation by which to seek damage compensation for patent violation is 2 years, beginning from the day the patent holder or person of common interest knew or should have known of the patent violation. If the review decision produced by the patent review commission or the ruling of the patent office is not

accepted, any litigation must be initiated at a people's court within 3 months of the day of notification. Initiating litigation after this period will not be heard by the court.

Based on the provisions of our patent law, counterfeiting another person's patent is a serious situation that constitutes a crime, and not only will he assume the responsibility for compensation of violations, but according to Article 127 in our penal code, for the crime of counterfeiting another person's patent, those directly responsible will be imprisoned for no more than 3 years, or have forced labor, or be fined. If patent office personnel collude in fraudulent practices with relevant personnel in concerned countries, that is a serious situation, and according to the provisions of Article 188 in the penal code, for bending the law for the benefit of relatives or friends, the penalty is no more than 5 years of imprisonment, or forced labor, or loss of political rights; where the circumstances are particularly serious, imprisonment may be for more than 5 years.

The patent laws of this country went into effect on 1 April of this year [1985]. Forecasting on the basis of patent applications, there will be constant occurrences of the kinds of patent disputes discussed above, and especially disputes about authentic rights to patents, disputes about violations of patents, and disputes about patent contracts. It might be that a department would constitute litigation, requiring resolution by the people's courts. The people's courts of this country will continue to accumulate experience through judicial practice, which will aid in even better executing patent law. They will protect the patent rights to inventions and creations, which will accelerate the development of science and technology.

12586

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## NATIONAL DEVELOPMENTS

### IMPORTANCE OF PATENT LAW IN TECHNOLOGY COMPETITION DISCUSSED

Beijing ZHONGGUO ZHUANLI [PATENT REVIEW IN CHINA] in Chinese No 2, 1986 p 6

[Article by Wang Wenjiang [3769 2429 3068]: "Patents and Technology Competition Among Enterprises"]

[Text] Over the last few years, use of the means of patent law protection has become more and more important in technology competition among enterprises. Therefore, many countries in the world are actively exploring patent strategies. We have just begun the patent process in China, and this is a new subject for study as we accelerate the technical advancement of enterprises. This paper presents some unformed opinions on this subject.

With the rapid development of modern science and technology, in competition among enterprises capital factors and material resource factors steadily fall into secondary positions, while factors of technology are raised to decisive positions. Because of this, for countries that implement a patent system an enterprise must formulate an accurate patent strategy in order to seek its existence and development and to safeguard its advantages in fierce technology competition. The enterprise must use the means of patent law to ensure the development of the enterprise's new technology and new products.

That this country has implemented a patent system has provided objective beneficial conditions for technical advances in enterprises for it provides legal protection for new technology and new products. Because of this, as enterprises formulate plans for production and operations and determine topics for technology development, they must undertake comprehensive analysis and study along the lines of patent management to provide a basis for enterprise development.

In international technology competition, enterprises are either putting out technology or are bringing it in, and this is much related to the patent strategy they have formulated, for if the patent strategy they have selected is not correct, this will not be of use to the development of the enterprise. Therefore, when studying the relations between enterprise technology competition and patents, we must not disregard the efforts of patent strategy selection.



At the development and research stage for new technology, the focus of patent strategies is in providing effective patent technology information to provide a basis for new technology development. At the production and sales stages, the core of patent strategy is the protection and maintenance of patent rights. There is an intimate relation between patent strategies and enterprise operations strategies and development strategies. According to Japanese statistics, the majority of enterprises obtaining patents are developmental enterprises that emphasize technology development.

The patent strategy system may be divided into three portions: 1. information, that is, the circulation and utilization of patent information and patent knowledge; 2. law, that is, use of the patent system and the obtaining, protection, and exercise of patent rights; 3. technology, that is, the development of new technology and the use and shifting of new technologies.

Patent information is the heart of the information aspects of patent strategies. Through control of patent information, not only can the circumstances of patent ownership of other enterprises be understood, but the trends in the development of new technology can also be known. Just by studying the proportion of patent ownership of an enterprise, one can know in large part the technical power of this enterprise. By reading patent publications, one can also discover product development directions with the greatest future.

The focus in legal aspects of patent strategies is on the obtaining of invention rights. Making use of "opportunistic strategies," some enterprises, through analysis of the situation for technology competition have mastered the standards and directions for technology development among competitors. Only when they see that technology competitors are about to catch up do they apply for patent rights. When selecting a patent strategy, factors that should also be considered are what degree of threat it would be if other enterprises obtain that technology or invention. When the threat is great, then adopt a strategy whereby a large portion is public, but where key technologies are not public, which will be secret tricks of the trade. This is the strategy often used by foreign enterprises in technology competition.

The focus of patent strategies in the aspect of technology is to actively use patent information for forecasting of trends in technology development. Because of the steady specialization, integration, and complexity of modern technology, the majority with the greatest futures are in the newest fields of technology. Whether or not new technologies for enterprise development will be used by the enterprise in question will be determined by circumstance, and the standard for evaluation is the principle of obtaining the greatest benefit. Sometimes, this is only used by this enterprise for technical monopoly; sometimes it is for sale at a high price to obtain the highest profits; sometimes it is to obtain a mutual transfer of rights, exchanging for technology needed by the enterprise in question.

As science and technology continue to develop, the degree of technology intensiveness for our export products will gradually be raised, and if we wish to maintain competitive advantages we must use the means of patent law. If exported technology can be patented, then we must certainly apply for patents

and protect patents first, and then export that technology. This way, when technology is exported, advanced technology will not be copied. Therefore, in technology competition among enterprises patent management is important work. Abroad, patent management departments are the highest staff departments in the enterprise and are directly led by the highest decision making personnel in the enterprise. Medium and large enterprises not only have specialists in charge of patent work, but also have corresponding patent management structures, i.e., patent departments or patent sections. The functions of these patent personnel are to be responsible for patent applications for the technologies and inventions of the enterprise in question, to provide an advantageous environment and conditions for inventing and creating; handling the affairs concerning patent rights; developing a licensing trade; providing a patent information service; and promoting technical, inventive, and creative activities for the staff of the enterprise.

In summary, there is an intimate relation between patent strategies and enterprise technology competition, and using the means of patent law to safeguard enterprise technology competition is an important task.

12586

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## NATIONAL DEVELOPMENTS

### ASPECTS OF MILITARY SUPPORT OF CIVILIAN GOODS PRODUCTION ANALYZED

Beijing HANGKONG ZHIZAO GONGCHENG [AVIATION PRODUCTION ENGINEERING] in Chinese  
No 9, 1 Sep 85 pp 28-29

[Article by Cheng Lianjun [4453 3353 8823]: "Investigating the New Regime of 'Meeting Military Quotas While Transferring Technology to Civilian Goods Production'"]

[Text] At this year's conference of aviation industry enterprise and service management personnel, Minister Mo Wenxiang [5459 2429 4382] announced the requirement that the aviation industry must adapt itself to the overall situation in national construction, transferring technology to civilian goods production while assuring the fulfillment of military quotas, and make the transfer on a large scale, rapidly and comprehensively. This is a major step in further implementing the policy of linking military and civilian production, combining production for peace and war, giving military goods priority and having civilian production nourish military production. Some views, dealing only with how the national defense industry should make the changeover to transferring technology to civilian production while assuring military production quotas, are put forward; corrections are welcome.

#### I. Liberate Thinking, Raise Consciousness, Intensify Awareness of the Importance of Assuring Military Production Quotas While Transferring Technology to Civilian Goods Production

In recent years the aviation industry has made great progress in implementing the policy of linking military and civilian production and making a major effort in civilian goods, and the results have been gratifying. But complete unity in understanding the policy of linking military and civilian production has not been achieved, thinking has not been sufficiently liberated, and a deeper understanding of the new situation is needed. Comrade Deng Xiaoping has stated that in addition to carrying out the armaments and equipment research and production tasks specified by the State Council and the Central Military Commission, all elements of the national defense industry must devote themselves fully to civilian goods research and production. Premier Zhao Ziyang recently stated that "converting military industrial technology to civilian uses is extremely important." In other words, the entire national defense industry is faced with two major tasks, namely promoting the modernization of national defense and at the same time promoting the

development of the national economy. This policy is in accord with China's national situation, as outlined in detail below.

A. It is suited to the needs of national economic development. As modernization is pursued on all fronts, and as the economic policies of opening to other countries and stimulating domestic development are thoroughly implemented, both key state projects and the technical modernization of existing enterprises urgently require large amounts of technically advanced, top-quality equipment and technical assistance. In addition, as the people's material and cultural standard of living is raised, there is an increasing need for attractive, inexpensive, high-quality goods. The national defense industry has the best equipment in the country, a full range of research and production facilities, and abundant technical capabilities; if they are incorporated into the unified plan for national economic development, they can be a mainstay of vigorous economic development.

B. It springs from the characteristics of production in the military industries. For the last 30-odd years, under extremely arduous financial and material conditions, China has nonetheless expended considerable effort to give the national defense industry the production and research capabilities to deal with a "sudden outbreak of war." It is now possible that the forces maintaining peace throughout the world will make further progress and that there will be no large world war for a long period, so that we should concentrate our efforts on economic development; this has made it necessary for the national defense industry to direct its surplus capabilities, beyond those involved in research on and production of military products, to civilian uses, integrating military production with civilian production, and supporting the development of the national economy.

C. It is urgently needed in order to increase the national defense industry's capability for self-renovation and self-development and to strengthen its qualities. The reorganization of the economic system that is currently under way requires that the enterprises genuinely develop into relatively independent economic bodies and become autonomously managed socialist producers and operators with responsibility for their own profits and losses and with the ability for self-renovation and self-development. This reform, which centers on strengthening enterprise vitality, is also entirely suited to the national defense industry. In this new situation, while submitting to the state plan and state management, the national defense industry must do everything possible to expand into more product markets and technology markets, to satisfy complex and ever-changing social needs, and at the same time to acquire the funds needed for self-renovation and self-development; in the process of servicing civilian needs and transferring technology to civilian uses, it must copy the strong points of the civilian industries and train scientific and technical personnel.

Only by unifying their thinking, overcoming the fear of difficulty and the preoccupation with temporary measures, making up their minds to engage in civilian production over the long term, and engaging in comprehensive planning, will it be possible to implement fully the policy of transferring technology to civilian production while meeting military quotas.



## II. Improve Organization, Establish a Management System To Coordinate Military and Civilian Production

Organizational measures are an urgent requirement for instituting the new regime of technology transfer to civilian production while meeting military quotas. Implementation of this policy goes hand in hand with the current "redirection and revamping" of enterprise management. At present, while the military industrial enterprises' conceptions of management, markets, competition, production startups, and finance have not been finalized and the production management model has not entirely taken shape, this will unavoidably increase the difficulty of instituting the new regime.

A. In macroscopic economic management, the central, province and municipality economic management bodies must incorporate military industrial capabilities under their jurisdiction into the economic development plans at the various levels, establish ties between higher and lower levels, and create a management system for linking military and civilian production that has a certain amount of authority. Recently some provinces and municipalities have organized "coordinating committees," "liaison committees," or various types of technical services companies to act as go-betweens and to establish contacts between higher and lower levels in order to tie the relevant bodies together into an organic whole; this is clearly beneficial as a transitional measure.

B. While working vigorously to improve social organization, military industrial enterprises and their cognizant departments (including companies, bases, management offices and ministries) must make realistic efforts to strengthen leadership, improve organization, and create mutually compatible management bodies for integrating military and civilian production. In general, the following five functional systems must gradually be developed:

1. a market information collection, market forecasting and plan coordination system to provide data for correct management decisionmaking;
2. a civilian products development system to modernize and upgrade products continuously and to maintain strong market vitality;
3. a civilian products production system that uses rational adjustment and allocation of production capabilities to adapt to requirements for production of civilian goods in lots of specific sizes;
4. establishment of a multilevel, multichannel civilian goods marketing network and technical services system, which is a key link in developing civilian goods production;
5. a scientific and technical consulting service system to promote the transfer of military industrial technology to civilian industries and to make thorough use of the excellent technical capabilities of military industrial enterprises.

If these five systems join with social organizations to develop vertical administrative systems and trans-department, trans-industry horizontal



interconnections into matrix organization structures and cooperative network systems, and if an appropriate operational management system is then drafted, it will be possible to implement the civilian technology transfer policy effectively.

### III. Rational Policymaking, Effective Choice of Civilian Products and Forms of Technology Transfer

In the present new situation, transfer of technology to civilian production while meeting military quotas has two implications. One is that the military industries' production capabilities are to be used in an energetic effort to organize civilian production by directly furnishing products to equip and renovate civilian industry and to satisfy social consumption requirements in order to make up for deficiencies in the production capabilities and technological levels of local civilian industry. The second is that military industrial technology is to be transferred to civilian industry and economic and technical cooperation between military and civilian production are to be developed in order to improve the technical standards of civilian industries and to promote technical progress. To achieve genuine results in these two areas, great emphasis must be placed on management policymaking, the key factor in which is the choice of methods for choosing civilian products and forms of technology transfer.

#### A. Choice of Civilian Products

Correct choice of civilian goods to produce is critical to the success of military-civilian production coordination. In choosing civilian products, the following principles should be strictly adhered to.

1. First, every effort must be made to develop combined military-civilian usability, technological compatibility, similarity of production processes, and similar design. This will allow thorough utilization of existing production capabilities, expand the size of production lines, shorten the research and development cycle, decrease product costs and reap good economic benefits.

2. The path must be cleared for civilian products rather than "competing for food" with them, and every effort must be made to develop technology-intensive product designs. On the one hand it is possible to focus on equipment urgently needed for technical renovation of civilian industry and on products in short supply which it is difficult for most civilian industries to make, but for which society has an urgent need and which have good development prospects; on the other hand the long view must be taken, and emphasis must be placed on utilizing the technical strong points of military industrial enterprises and choosing "high-quality, high-precision, sophisticated" high-technology products of complicated design that are extremely technology-intensive. This not only will promote market competitiveness, but will also help to raise the technical level of military production.

To implement this policy, it will be necessary to conduct detailed market research, with a particular focus on undeveloped markets; the main effort must be devoted to identifying undeveloped market potential. This potential

is rather great in China, and the military industrial enterprises can bring their technological superiority fully to bear in this area.

3. Attention must be devoted to selecting products suited to diversified, multichannel joint production, either local or on a multilocality, multiindustry basis, or even joint production that breaks through the boundaries between different ownership systems. Most military industrial enterprises have rather strong integrated assembly and adjustment and testing capabilities, so that models that are not entirely technology-intensive may be selected when environmental analysis indicates the possibility of organizing dispersed processing and joint production of parts and components with relatively low technological requirements that can be processed in rather large quantities. This allows rapid adaptation to changes in product design, allows the size of production lots to be increased, and makes it possible to take full advantage of the strengths of both military industrial enterprises and civilian enterprises.

4. Effective feasibility studies must be made when choosing civilian products, together with technological and economic evaluation, in order to assure that the return will be greater than the investment and that good economic benefits will be obtained. Naturally, in the process of technical and economic evaluation, the principle of equal emphasis on enterprise economic benefits and economic benefits to society must be adhered to.

#### B. Choice of Types of Technology Transfer

The following forms of transfer of military technology to civilian industries currently exist.

1. Transfer of development results. This means compensated transfer of mature product development results, manufacturing processes, metallurgy, computer software and other research results to civilian enterprises and the expansion of their applications in order to promote the technical progress of civilian producers.

2. Joint military-civilian task forces. In this method, either personnel are sent to participate in key high-yield technology projects dealing with long-standing or new weak links in production by civilian enterprises, or manufacturing, installation, adjustment and testing tasks are taken on as joint task force efforts so as to bring about technology transfer in the course of problem solving.

3. Joint production and joint product development. In this method, certain key products are chosen, economic and technical cooperation with civilian enterprises is organized, and joint production or joint research is carried on.

4. Suitable opening up of military industrial units' advanced equipment, special processing technologies, or experimental, testing, measurement, computation and other material and technical facilities to serve civilian industry; in addition, core technical groups or various types of specialized personnel can be trained for civilian industry.

5. Technical consultation services. This method makes use of the military industrial enterprises' abundance of technical personnel and knowledge-intensive character via participation in various consulting organizations, acceptance of large amounts of consulting tasks and problem solving for civilian industries, and information sharing and provision of data. This is the most common and flexible form of technology transfer.

6. Entry into economic zones and coastal open-door cities. Coastal open-door zones are windows looking both inward and outward, and by virtue of their strong points, military industrial enterprises are fully able to play a greater role there, to combine the transfer of technology to civilian industries with the assimilation of imported technologies, and to engage in domestic and foreign trade in which industrial or technical activity is combined with trade.

To summarize, selection of civilian products and choice of forms of technology transfer are major policy problems in the course of transferring technology to civilian production. All types of technical and economic evaluations should be carried out, using extensive investigation, scientific analysis and calculations, and while assuring correct decisionmaking, no time should be lost in organizing and carrying out these activities thoroughly and successfully. It must be realized that as the situation develops, on the one hand society's requirements are expanding and the various industries' needs for technological progress are becoming increasingly pressing, while on the other hand market competition is becoming increasingly fierce. Therefore we must always assure that products are of high quality, incorporate new technologies, are inexpensive to produce, have a short development cycle and win a good reputation, and we must strive to unify the concerns of speed, benefits, standards and investment in order to promote economic and technical cooperation between military and civilian industry and to implement the strategic policy of transferring technology to civilian industry while meeting military quotas.

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## NATIONAL DEVELOPMENTS

### NATIONAL CHEMICAL CONFERENCE ENDS IN BEIJING

OW300313 Beijing Domestic Service in Mandarin 1100 GMT 29 Apr 86

[Text] The National Conference on Chemical Work, which ended today in Beijing, emphatically pointed out: To fulfill the basic tasks of the chemical industry during the Seventh 5-Year Plan, we must vigorously promote five spirits: The pioneering spirit of the foolish old man who removed the mountain, the spirit of boldly making innovations, the spirit of plain living and hard work, the spirit of extensive socialist cooperation, and the spirit of workers being the masters of their own affairs.

The conference pointed out: To achieve the goals set for the chemical industry during the Seventh 5-Year Plan, the most important thing is to bring into play our subjective initiative, press forward in the face of difficulties and overcome them, and tap the potential of existing enterprises.

The conference pointed out: Man must have some revolutionary spirit. With this spirit, we will be able to march forward courageously and overcome all kinds of difficulties. We relied on this spirit to establish and develop our country's chemical industry. Under the current situation of reform, opening to the outside world, and stimulating the economy, we should be even more vigorous in keeping up this spirit.

The conference emphatically pointed out: In recent years, the chemical industrial departments have given less attention to these spirits and the people's sense of them has been blunted. Now we must give wide publicity to the five spirits from the higher levels to the grass-roots and make new contributions to fulfilling the goals for the chemical industry during the Seventh 5-Year Plan and to rejuvenating the chemical industry.

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12 June 1986

## NATIONAL DEVELOPMENTS

## SCIENTIFIC RESEARCH AWARDS CEREMONY

OW151044 Beijing XINHUA in English 0958 GMT 15 May 86

[Text] Beijing, 15 May (XINHUA)--Scientists, technicians and inventors who have made major contributions to national economic, social or defense development were presented with trophies, medals and certificates at a meeting here today.

Party and state leaders Zhao Ziyang, Wan Li, Xi Zhongxun, Fang Yi, Li Peng, Yang Shangkun and Hu Qili were among 7,000 people who attended the prize-giving ceremony in the Great Hall of the People.

It was the second such prize-giving since a national scientific meeting was held in 1978.

National awards for promoting scientific and technological advances were presented for 1,761 scientific research achievements in such fields as nuclear physics, rocket technology, medicine, machine-building, electronics, chemicals, metallurgy, energy, textiles, agriculture, forestry, water conservancy, communications and transport.

Premier Zhao Ziyang extended congratulations on behalf of the communist party Central Committee and the State Council to the prizewinners, and said they had all made important contributions to national development.

He said the achievements had resulted from determined efforts by the scientists based on the results of research by their predecessors and with the help of many ordinary workers.

National awards for inventions were presented for another 185 items, including the "Mianyang Number 11" high-protein, high-yield wheat strain, and a highly-successful method of replanting severed limbs. Forty of these also won international awards.

In addition, 3,896 achievements were commended nationally for the promotion of science and technology during the Sixth 5-Year Plan (1981-1985).

Also attending today's meeting were representatives of winners of 42 medals at international invention fairs in Geneva and Yugoslavia earlier this year, and of winners of 4 gold medals at a world youth invention achievement exhibition in Bulgaria last year.

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CSO: 4010/2017



## NATIONAL DEVELOPMENTS

### APPLICATION OF S&T RESEARCH RESULTS DISCUSSED

Beijing GUANGMING RIBAO in Chinese 23 Mar 86 p 1

[Report by Yang Zhonglian [2799 6988 3425]: "Science and Technology Must Pay Attention to Applications and Spur Development"]

[Text] We read some news in the newspaper: in the research field of fuzzy mathematics, China was some 10 years behind some of the advanced countries of the world, but through urgent and direct efforts we have become one of the four strongest contingents in this area, abreast of the United States, Japan, and some European countries. It turns out that at the same time that fuzzy mathematics researchers in this country have been engaged in theoretical research, they have joined with specialists and scholars in real applications to make fuzzy mathematics a part of the natural sciences and even part of many applications fields of the social sciences. This has consequently allowed this discipline to flourish in China. As this fact so strongly demonstrates, paying attention to applications and spurring development is the correct path toward invigorating science and technology activity in this country.

From the viewpoint of the theory of dialectical materialism, when people discover, invent, and create things empirically in science and technology, that is certainly through a leap in cognition, while applying these discoveries, inventions, and creations to transforming the world is an even more important leap in cognition. In the actual process of applying science and technology to the transformation of the world, there are new advances, and consequently to an even greater degree and even broader context it enriches mankind. Obviously, applications are the final goal of science and technology, and are also the starting point through which science and technology gain new advances. In this demand to pay attention to applications and spur on development, the key is paying attention to applications. We say that science and technology are production forces, by which we mean production forces that are direct transformations of science and technology through dissemination of applications.

In the past few years, applications and developments of science and technology in this country have taken a good turn toward prosperity. New advances in China's satellite communications engineering are an obvious indication. If the rocket technology for launching synchronous satellites had not been applied, then in 1984 we could not have put our experimental communications satellite into a geosynchronous space orbit. Also, only because of the

practice gained through the launch and testing of the experimental communications satellite, when Chinese workers in space and electronics technologies deepened their understanding of synchronous communications satellites, could they successfully launch this year the functional communications broadcast satellite that was more precise in position and had better functions. However, we should also see that we have many scientific and technical achievements that have not been well disseminated or applied. Only about half the number of applications research achievements of certain science research organizations that could be sold have been.

Looking for reasons, they might be: the research achievements do not suit objective needs, or they might be too expensive to turn into products. This then requires that when organizing the work of science and technology we fully understand the needs of the marketplace, that we better provide "marketable" technical achievements, and also that we improve the functions of achievements through the creative efforts of scientists and technicians. Another reason is in the area of ideological awareness. Some comrades always feel that technology and equipment are all right for foreigners, where it is clear that we have things in this country and yet we do not hesitate to spend foreign exchange to buy them abroad. For these reasons it is necessary to provide through legislation that in situations where functionality and price are more or less equal, preference will be given to adopting domestic scientific and technical achievements while limiting imports. Otherwise, we cannot safeguard the development of our science and technology through application. Naturally, we will still enable our scientific and technical achievements to attract domestic customers through market competition and capture international markets.

Paying attention to applications also includes "pick-upism" and applying the advanced foreign scientific and technical achievements that we lack. Regarding the problem of how to "pick up," we once traveled a circuitous path. More clearly, to just pick up foreign eggs and directly consume them cannot be done, and to pick up the foreign hen (including foreign chickenfeed) and bring it here to lay and raise the eggs is also not a good policy. What we ought to do is to import the advanced technology from other countries, assimilate it, and make it our own. Beginning in the 1960's, Japan spent 80 percent of the capital it used for importing on software and buying patents. They were very strict about buying ready-made equipment, and expenses for assimilating and absorbing imported technology were many times that of the expenses for importing technology itself. Science and technology in Japan after the war to a very great degree used this kind of "pick up" method to directly catch up to the United States and Europe. We can learn from this experience.

Paying attention to applications promotes development, and definitely does not mean that through application all science and technology will naturally develop. Here, the word "promote" is all important. Scientific and technical workers must develop their own independence through actual practice before it will be possible to surpass the accomplishments of those who came before and to have new discoveries and gain new applications. Science and technology management departments will also have to exert more effort on behalf of the word "promote" to arouse the enthusiasm of scientists and technicians through correct policies.

To stress attention to applications and promotion of development in no way means that we should neglect basic research. A country as large as ours needs, without doubt, to have a corresponding group of outstanding scientists and technicians to engage in exploratory work never before attempted, but speaking from the needs of China's economic construction, the focus of basic science research should still be subjects with a future in applications. This is especially true for research projects faced with the characteristics of our natural conditions and natural resources, about which there is also no doubt.

12586

CSO: 4008/2096

NATIONAL DEVELOPMENTS

SCIENTIFIC EXPLORATION TEAM TO EXPLORE CHANG JIANG

OW201440 Beijing XINHUA in English 1408 GMT 20 May 86

[Text] Beijing, 20 May (XINHUA)--A scientific exploration team is to sail down the Chang Jiang, China's longest, beginning at the end of June or the beginning of July.

The river is 6,300 km long, with a drop of 5,400 meters. If the team succeeds in the exploration, it will break the world record made by a Japanese who had sailed the 6,000 km Amazon with a drop of 3,200 meters, said the overseas edition of today's PEOPLE'S DAILY.

The 6-month exploration will be jointly sponsored by the Chengdu Institute of Geography of the Chinese Academy of Sciences, the Sichuan Provincial Commission of Physical Culture and Sports, and the Sichuan Provincial Society of Geography.

The daily said the 30 team members--averaging 25 years in age--were selected among 300 applicants from all over China.

It quoted deputy team leader Tang Bangxing as saying that they were now receiving training "somewhere in Sichuan Province."

Tang is a mud-rock-flow expert and deputy director of the Chengdu Institute of Geography.

The first attempt at sailing the length of the Chang Jiang was made by 34-year-old Chinese photographer Yao Maoshu last year. Yao died while trying to navigate the part of the river in northwest China's Qinghai Province.

"We are determined to conquer the river with team work," Tang said.

/12232

CSO: 4010/2017



## NATIONAL DEVELOPMENTS

### SCHOLASTIC ACTIVITIES AT CHINA UNIVERSITY OF S&T DESCRIBED

Hefei ANHUI RIBAO in Chinese 26 Feb 86 p 1

[Report by Zhu Guanghua [2612 0342 5478]: "The Scholastic Atmosphere is Dense: Talent is Coming Out in Large Numbers and There is a Great Show of Abilities"]

[Text] The China University of Science and Technology has diligently implemented the Party's "double hundred" principle, and the scholastic atmosphere is pronounced. Here, all schools of thought can be developed, and all kinds of talent can make itself known, and the entire campus is full of life and energy.

Here, announcements for various scholastic reports can be seen every day, those in charge enjoy reputations as scholars throughout China, and there are also students and graduate students of the particular disciplines who are "just taking their first steps." Whether or not your qualifications are extensive or slight, whether or not you have a title, as long as you have a unique worthwhile solution, you will be heard. Here, various different schools of thought can both "occupy the stage at the same time" and can also "contend for attention in the same room," for everyone will accept the strengths and compensate for the weaknesses, there is constant innovation, and relations are extremely harmonious. The astrophysics center of this school has maintained freedom of course selection since its inception in 1973, as well as freedom of organization, and the principle of free discussion, with a 2-hour conference every Friday. Among the members of this center there are different views regarding the question of the form of the dimensional structure of the universe, but they continue to explore together, exchange notes with each other, so that all levels have been greatly improved. In recent years, more than 200 papers have been published in scholastic journals both domestic and foreign, and the center was awarded first and third prizes by the 1985 International Gravitation Society for papers. Only one of the original five members of the center was a lecturer, while now they have developed to the point of having 14 members, among which 5 are full or associate professors, 3 are PhD's, 2 are diligently pursuing their doctorates, 4 are lecturers, and they have become a fresh new force in the field of astrophysics research that has attracted attention both foreign and domestic.

The Chinese University of Science and Technology is a stage for the young to show their abilities, and the school has allowed young and middle aged people

be the first line "selection bridge" in teaching, research, and management. The great majority of the school's primary lecturers, those in charge of research topics, heads of teaching and research sections and of laboratories, and heads of sections, offices, and departments are all young and middle aged. The school encourages young people to strive for the front ranks of science and technology. Last year, at the all-China engineering thermophysics annual meeting, 9 people from the school were invited to attend, 6 among whom had just graduated or were still graduate students, and 13 papers were read at the conference, which attracted the attention of those in the same field. In recent years, the school has had an open policy and has sent more than 600 young and middle aged teachers and students abroad for advanced studies, of whom more than 200 have already returned to offer more than 100 new courses. In recent evaluations of academic positions, this school, whether in funds or personnel, has maintained standards and stressed contributions, and the evaluation of the committee to check academic ranks was: among lecturers 45 years of age and younger, 6 were promoted to be professors and 47 to be associate professors; another 7 young teachers under 40 were promoted to associate professor. Chen Lin [7115 7207], only 40, of the biology department was promoted ahead of his field to full professor because of his outstanding achievements in science and technology, for which he was awarded a first place prize by the Academy of Sciences for major scientific and technical achievements.

After this school began to be led by a group of specialists and scholars, great care was taken to guard against the tendency for "like professions to repress each other," and to give full play to the role of the great body of teachers in managing studies and running the school. Six school leaders have implemented a division of work and assignment of responsibility to individuals for sections, offices, and departments. They will often look into lower levels, will understand the situation, and it has been ruled that every Saturday afternoon is a "school director reception day." The school director and deputy directors will take turns in meeting with teachers and students who come and in handling the problems they raise. They also regularly hear inquiries from anyone, as for example in one half-day meeting where school director Guan Weiyan [4619 1919 3508] went to the platform seven times to respond to everyone's questions.

12586

CSO: 4008/2091

## NATIONAL DEVELOPMENTS

### JIAOTONG UNIVERSITY'S SUPPORT OF LOCAL ECONOMY DISCUSSED

Xian SHAANXI RIBAO in Chinese 11 Mar 86 p 3

[Report by Zhang Guangqiang [1728 0342 1730] and Gu Pinliang [7357 0756 5328]:  
"Xian's Jiaotong University Makes Outstanding Record for Invigorating the  
Shaanxi Economy"]

[Text] In invigorating economic construction in Shaanxi, the Xian Jiaotong University has had an outstanding record. Since the 3d Plenary Session of the 11th CPC Central Committee, this school has obtained 403 scientific and technical achievements, 68 of which have reached or approached international standards and 311 of which filled domestic gaps or reached advanced domestic standards. According to incomplete statistics, industrial technology achievements already disseminated and applied have created economic results for the state of nearly 500 million yuan.

Xian's Jiaotong University has used the benefits of its own talent and the characteristics of its varied curriculum to enthusiastically develop scientific and technical cooperation with enterprises affiliated with Shaanxi Province and with Xian at the same time as it has enthusiastically taken on major national tasking. At present, this school has set up cooperative relations with 144 industrial enterprises in this province, and has signed up for 320 scientific and technical cooperative projects concerned with technology transfer, transfer of rights to achievements, importation and assimilation, new product development, commissioned development, and joint problem solving. They are helping to develop new products for some technically backward collectives and small factories with unsalable products using enthusiastic technical and talent support. They have helped the Xian Radio Factory No 14, the Xian Atmospheric Boiler Factory, the Xian Fuse Plant, and the Tongchuan Abrasion Materials Plant develop new products, allowing these enterprises which perennially lost money and which were on the verge of closing their doors to regain vitality.

They have also developed four national level high quality name brand products for some of the industrial enterprises in this province; they have directly transferred the rights to 36 scientific and technical achievements. They have helped a group of established enterprises accomplish 120 projects in technology transformation, have helped more than 50 professors and associate professors gain positions as technical consultants with some enterprises, and have helped train more than 1,200 technical personnel for relevant factories and mines.

NATIONAL DEVELOPMENTS

BRIEFS

**QINGHAI MONOPOLIZES SILICON MARKET**--The Qinghai Province trade group is monopolizing the silicon market at the Guangzhou Spring Commodities Fair. All the silicon products of the whole country are being handled by the Qinghai group. There is a constant stream of foreign businessmen making inquiries at the group's reception office. (Shen Qikang), deputy manager of the provincial Metallic Minerals Import and Export Company, says that Qinghai has formed a silicon-producing combine to develop production of ferrosilicon and alloys. This will play a stimulating role in invigorating the province's economy. [Text] [Xining Qinghai Provincial Service in Mandarin 2330 GMT 17 Apr 86 HK] /12858

CSO: 4008/1061



PHYSICAL SCIENCES

HOLOGRAPHIC STUDY OF VIBRATION OF UNDERWATER SOUND TRANSDUCER

Qingdao SHANDONG HAIYANG XUEYUAN XUEBAO [JOURNAL OF SHANDONG COLLEGE OF OCEANOLOGY] in Chinese Vol 51 No 4, 15 Dec 85 pp 17-22

[Article by Liu Jilu [0491 4949 7120], Lu Deming [6424 1795 2494], and Li Xuan [2621 5503]]

[Text] I. Introduction

The method of interferometry used in laser holography is a new, high-precision measurement technique which has been widely used in science and technology. The continuous-exposure holographic method (or the time average method) is very effective in analyzing vibrating objects. This method provides high accuracy and is not constrained by the material or shape of the test article because it does not make mechanical contact with the test article. Today, oceanic development is becoming increasingly more important, and underwater sound transducer is an important device used in oceanic exploration, underwater engineering, off-shore petroleum exploration and production, shipping, and military engineering. The development of ocean science also imposes higher technical requirements on underwater sound transducer. Therefore, the study of high-efficiency, high-sensitivity transducers has become an important research topic for developing the oceanic industry. This article describes a method of using holographic methods to record the vibration patterns of the widely used piezoelectric transducer in order to study its vibration modes, amplitudes, and amplitude-phase distributions. This result provides useful experimental and theoretical data for the development, production, and testing of underwater sound transducers.

II. Basic Principle

In making holographic recordings of an object which is in simple harmonic motion, if the exposure time is much longer than the vibration period of the object, and when the reflected light from the object and the reference light on the holographic plate are coherent, then assuming that the recording and processing are both linear, the intensity of the object light after recurrence is:

$$I \propto \frac{|A_0|^2}{T} \left| \int_0^T \exp(jK\gamma Z \cos \omega t) dt \right|^2 \quad (1)$$

where  $\omega$  is the circular frequency of vibration,  $Z$  is the amplitude,  $\gamma$  is a function of the subtended angle between incident and reflected light,  $K = 2\pi/\lambda$ ,  $\lambda$  is the wavelength of the incident light.

By letting  $n = 0$  in the expression for Bessel function

$$J_0(x) = \frac{i^{-n}}{2\pi} \int_0^{2\pi} \exp(jx \cos \omega t) \exp(in t) dt$$

equation (1) can be reduced to:

$$I \propto |A_0|^2 J_0^2(K\gamma Z) \quad (2)$$

If  $\alpha$  is the angle between the incident light and the direction of motion of the object, i.e., the normal line to the reflecting surface, and  $\beta$  is the angle between the direction of observation and the normal line, then  $\gamma = \cos \alpha + \cos \beta$ . The above equation can be rewritten as

$$I \propto I_0 J_0^2(\varphi) \quad (3)$$

where

$$\varphi = \frac{2\pi}{\lambda} Z (\cos \alpha + \cos \beta) \quad (4)$$

and  $I_0$  is the light intensity corresponding to a stationary object, or a vibration node. The Bessel function can be computed using the following series expansion

$$J_n(x) = \sum_{k=0}^{\infty} \frac{(-1)^k}{K! (K+n)!} \left(\frac{x}{2}\right)^{2K+n} \quad (5)$$

The interference pattern on the recurrent holograph primarily reflects the position of deformation of the vibrating object.  $\alpha$  and  $\beta$  can be determined from experiments. The value  $\varphi = 0$ , for which  $J_0(\varphi) = 1$  and  $I = I_0$  corresponds to the positions of zeroth-order bright fringes, or zero displacement. Thus, the vibration-free region, or the vibration nodes are indicated by the brightest spots in the vibration pattern. The series of values of  $\varphi$  for which  $J_0(\varphi) = 0$  and  $I = 0$  correspond to the dark fringes. Other values of  $\omega$  for which  $J_0(\varphi)$  again reach maximum correspond to the bright fringes of different orders. Therefore, equation (3) represents the bright and dark fringes observed after recurrence of holographic interference on a sinusoidal vibrating surface; they correspond to the positions on the vibrating surface with different amplitudes. Thus, the position shape of the fringe pattern on a holograph directly reflects the vibration condition of the radiating surface of an underwater sound transducer. By studying these fringe patterns and calculating the vibration amplitudes  $Z$  and amplitude distribution from equations (3) and (4), one can perform qualitative and quantitative analyses of the vibration characteristics and important parameters of the transducer.

### III. Experimental Procedure

The holographic experiment was carried out on a shockproof optical table; its optical circuit is shown in Figure 1. In this figure, L is a He-Ne laser, t is an optical switch (1-100 second exposure time), s is a beam splitter,  $M_1$ ,  $M_2$  are reflecting mirrors,  $L_1$ ,  $L_2$  are beam broadening lenses, p is a continuous light-reducing plate, T is the underwater sound transducer, and H is the holographic plate. The difference in optical paths between the object light and the reference light is less than 2 cm; the intensity ratio between the object light and the reference light is approximately  $I_0:I_r = 1:1.5$ . The subtended angle between the object beam and the reference beam is  $\theta = 20^\circ$  to  $30^\circ$ .

The excitation circuit of the underwater sound transducer is shown in Figure 2.

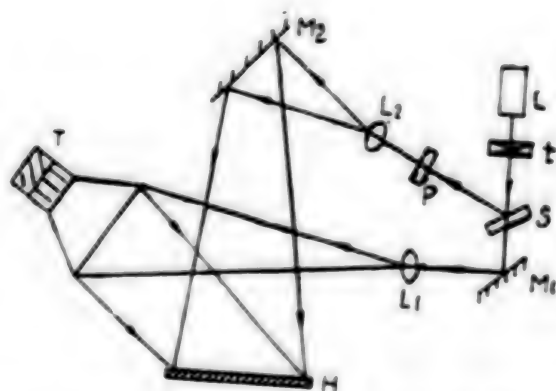


Figure 1. Optical Circuit for Holography

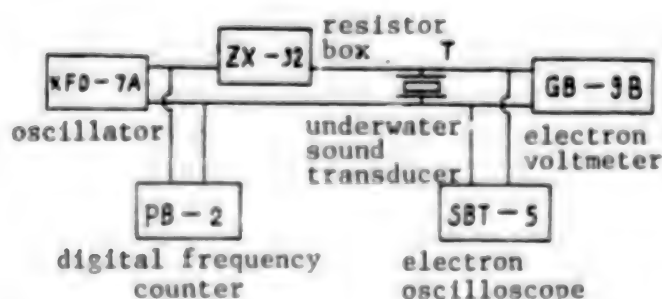


Figure 2. Block Diagram for the Excitation Circuit of the Underwater Sound Transducer

In this figure, T is a composite piezoelectric transducer whose drive element is PZT-4. The transducer is rigidly clamped to the table. The transducer, the oscillator, and the resistor are connected in series, and the operating voltage is measured by an electron voltmeter; the minimum voltage reading

indicates the resonance point. The frequency of the excitation voltage can be read accurately using a digital frequency counter, and the waveform is displayed on the oscilloscope.

#### IV. Results

The time average holographic pictures of the vibration modes of the radiating surface of an underwater sound transducer are shown on the next page. There are two types of radiation cover plates: a 78 mm cylindrical plate and a 98 mm circular plate. The drive elements are all PZT-4, 20 mm in diameter, and 5 mm thick.

Plate A shows a picture of the composite piezoelectric transducer where the radiating surface is stationary.

Plate B shows a picture of the radiating surface with a cylindrical cover plate; the operating frequency is  $f_B = 25304$  Hz, the excitation voltage of the oscillator is  $V_1 = 40$  v, the operating voltage of the transducer is  $V_2 = 20$  v, and the operating point is at the fundamental resonance frequency. The vibration pattern is uni-modal, and the nodal curve is a circle.

Plate C shows a cylindrical cover plate.  $f_C = 25980$  Hz,  $V_1 = 10$  v,  $V_2 = 3.8$  v, and the operating point is at the fundamental resonance frequency. The vibration pattern is uni-modal, and the nodal curve is a circle.

Plate D shows a circular cover plate.  $f_D = 27113$  Hz,  $V_1 = 50$  v,  $V_2 = 44$  v, and the operating point is at the fundamental resonance frequency. The vibration pattern is uni-modal, and the nodal curve is a circle.

Plate E shows a cylindrical cover plate.  $f_E = 52329$  Hz, which is at the second harmonic,  $V_1 = 53$  v,  $V_2 = 22$  v. The vibration pattern is uni-modal and the nodal curve is a circle.

Plate F shows a circular cover plate.  $f_F = 46802$  Hz, which is smaller than the second harmonic,  $V_1 = 58$  v,  $V_2 = 56$  v. The vibration pattern is a bi-modal, symmetric pattern.

Plate G shows a circular cover plate.  $f_G = 46952$  Hz, which is smaller than the second harmonic,  $V_1 = 57$  v,  $V_2 = 54$  v. The vibration pattern is a quadri-modal, symmetric pattern.

Plate H shows a circular cover plate.  $f_H = 91688$  Hz, which is smaller than the fourth harmonic.  $V_1 = 55$  v,  $V_2 = 53$  v. The vibration pattern is a multi-modal, symmetric pattern.

The amplitude distribution curves along the radial direction of the radiating surface calculated from equation (4) for the uni-modal case are shown in Figure 3.





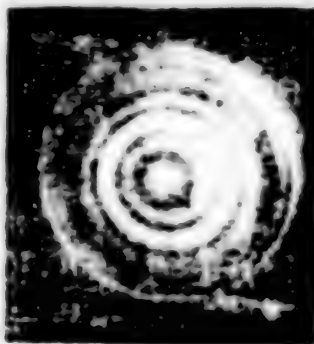
A. Radiating surface of the transducer is stationary



B. Cylindrical plate  
 $f = 25304 \text{ Hz}$ ;  $V_1 = 45 \text{ V}$ ;  $V_2 = 20 \text{ V}$



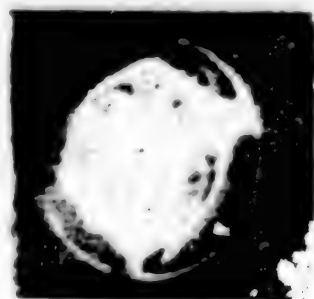
C. Cylindrical plate  
 $f = 26980 \text{ Hz}$ ;  
 $V_1 = 10 \text{ V}$ ;  $V_2 = 3.8 \text{ V}$



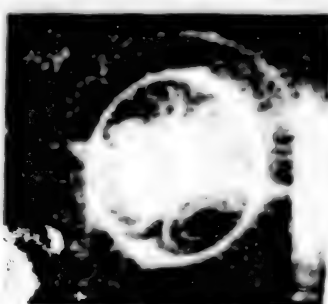
D. Circular plate  
 $f = 27113 \text{ Hz}$ ;  
 $V_1 = 50 \text{ V}$ ;  $V_2 = 44 \text{ V}$



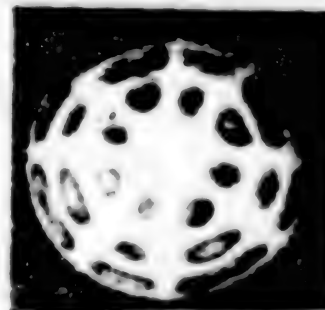
E. Cylindrical plate  
 $f = 52329 \text{ Hz}$ ;  
 $V_1 = 50 \text{ V}$ ;  $V_2 = 22 \text{ V}$



F. Circular plate  
 $f = 40802 \text{ Hz}$ ;  
 $V_1 = 35 \text{ V}$ ;  $V_2 = 34 \text{ V}$

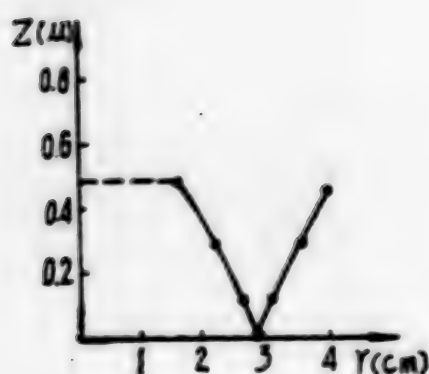


G. Circular plate  
 $f = 40802 \text{ Hz}$ ;  
 $V_1 = 37 \text{ V}$ ;  $V_2 = 34 \text{ V}$

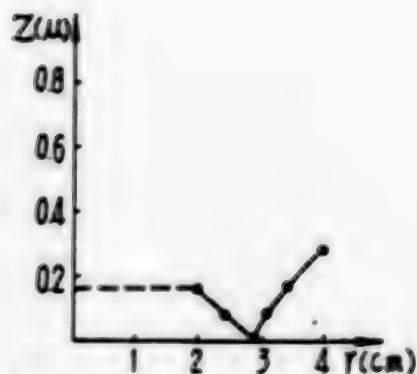


H. Circular plate  
 $f = 41800 \text{ Hz}$ ;  
 $V_1 = 35 \text{ V}$ ;  $V_2 = 33 \text{ V}$

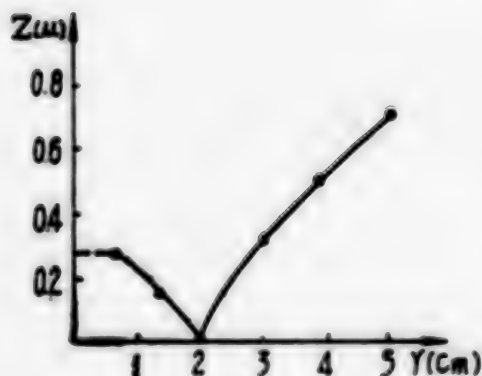
Pictures of Vibration Modes of the Underwater Sound Transducer



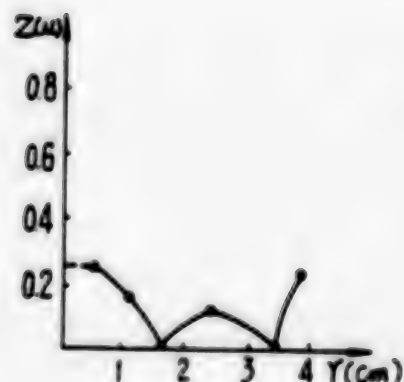
(1) Curve B



(2) Curve C



(3) Curve D



(4) Curve E

Figure 3. Amplitude Distribution Curves of the Radiating Surfaces of Underwater Sound Transducers

## V. Discussion

1. The vibration modes of the radiating surface of the transducer can be observed directly from the holograph. The vibration modes of the same transducer are different for different operating frequencies and excitation voltages. It can be seen from plates B, C, and the corresponding amplitude distribution curves in Figure 3 (1) and (2) that when a transducer is operating at the fundamental frequency, the amplitude increases with increasing operating voltage (within a certain range); the higher the operating voltage, the denser the fringe pattern, and the larger the amplitudes. At this point the emission efficiency of the transducer is high.

2. The center of the brightest region on the holograph corresponds to  $J_0^2(\varphi) = 1$ , or  $\varphi = 0$ ; since the amplitude is  $z = \frac{\lambda \varphi}{2\pi(\cos\alpha + \cos\beta)}$  it corresponds to the zero-amplitude nodal curve. For a transducer operating at the

fundamental frequency, the nodal curve is a circle, as shown in plates B, C, and D. At the second harmonic or higher frequencies, plates F, G, and H show that the vibration-free region (i.e., the nodal curve becomes a complicated symmetric pattern, and the amplitude distributions are also more complex (multiple modes). In this case, small changes in frequency or excitation voltage will cause large variations in the vibration modes (see plates F and G). The radiating surface becomes divided into several small regions, with the region of maximum amplitude reduced and the amplitudes diminished. Hence the performance of the transducer is degraded.

3. It can also be seen from the holograph that there may be two fringes on the same picture with equal brightness (see plate E), and the relative brightness remains unchanged when varying the recurrence angle. In this case the radiating surface has two nodal curves, hence the amplitudes of the corresponding points on the radiating surface are reduced (see Figure 3(4)), and the performance of the transducer is also degraded.

4. Since the radiation cover plate and the drive element are rigidly attached by prestressed bolts, the central sections between the radiating surface and the drive element have approximately equal amplitudes. This is reflected as a bright, uniform region on the holograph.

Holographic study shows that the vibration pattern of the radiating surface and the number, shape, and distribution of nodal curves depend on the shape, dimensions, operating frequency, and excitation voltage of the transducer. In transducer design, when the shape and dimensions are specified, the vibration modes and amplitude distributions of the radiating surface can be studied by using the laser holography time average method to provide important data on such parameters as directivity, radiated power, and receiving sensitivity.

The authors would like to express their thanks to Comrade Yu Suolong of Bureau 715 for valuable discussions during the course of this work.

3012/9365  
CSO: 4008/1056

## APPLIED SCIENCES

### PROPULSION ENGINEERING RESEARCH DESCRIBED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 11, Nov 85  
pp 32-33, 31

[Article by Aircraft Engines Department, Nanjing Aeronautical Institute: "A Brief Introduction to Propulsion Engineering Research at Nanjing Aeronautical Institute"]

[Text] In order to improve the technical characteristics of aircraft, their power plants must have excellent performance characteristics, such as high thrust, high efficiency, and long life. New progress must therefore be made in power plant research: on the one hand we must focus on improving the performance of all assemblies and their mutual compatibility, while on the other hand we must achieve integrated power system control. Thus the scope of work must be expanded and its subject matter must be extended into several adjoining or overlapping areas of science.

In recent years the Aircraft Engines Department of Nanjing Aeronautical Institute has conducted a series of theoretical and experimental studies related to the above two points and has achieved new progress, particularly in such areas as intake duct flow, combustion stability and flow field analysis, high-temperature turbine blade cooling techniques, impeller flow, strength and vibration of structures, system control, and microcomputer control, and has produced some quite respectable results.

#### Intake Duct Flow Research

In order for the compressor to achieve the desired intake flow field states under all working conditions, full studies must be made of flow and flow-field conditions inside the intake duct. Our intake duct research laboratory was established in the 1970's, and it has conducted a series of investigations related to improving intake flow field quality in the last 10-odd years. First, we used simulation boards to conduct experimental studies on the stability characteristics of intake duct flow fields, which yielded excellent results and provided effective modeling techniques for matching power plants to aircraft. Next we studied the use of eddy generators (vane type and air turbines) on boundary layers, providing useful design methods for improving intake flow field characteristics. We also did a great deal of research on the unstable flow mechanisms resulting from the interaction between shock



waves and boundary layers. The Royal Aircraft Establishment (RAE) of the United Kingdom wrote a report on our research results in this area, and we are now further developing this research on turbulence generation mechanism and applications. In addition, we have conducted various flow fields studies on subsonic diffusers, providing reliable data for diffuser design. We have made excellent progress in flow-field calculations and experimental studies of viscous compressible fully turbulent flow and vortical flow, which have won respect both at home and abroad. The Rolls Royce Company (U.K.) has used certain of our data as standards for its measurement of intake capabilities.

#### Research on Impeller Flow

In order to achieve the optimum relationship between compressor efficiency, geometrical characteristics and weight, we undertook research on the "tandem cascade" design; gratifying progress has already been achieved in research related to the selection of geometrical characteristics of tandem cascade blades and their relationship to flow characteristics, providing useful figures and information on tandem cascade design. We made calculations on two-dimensional flow field characteristics of viscous large-angle impeller channels and proposed that the solution method for viscous flow equations on a curved surface be extended to three dimensions. In nonconstant flow, we conducted research on the mechanisms of axial transfer of intake distortion and the effect of geometric characteristics on distortion and made an analytical study of the applicability of compressor surge/rotary speed loss criteria in real engineering problems. This work advanced research on operating characteristics of the entire compressor and on compressor matching.

#### Research on Combustion Stability Characteristics and Flow Fields

In order to assure correct, reliable afterburner starting under a variety of working conditions and stable, high-efficiency operation, we have carried out numerous research studies on ignition techniques and combustion stability, as well as return-flow zone flow fields. The results of research on catalyzed ignition and on evaporation-type stabilizers were as advanced as their foreign counterparts. Research on precombustion-type stabilizers was also carried out. These stabilizers have already demonstrated in certain bench tests that they have considerable potential for decreasing fuel consumption and increasing combustion efficiency; recent flying tests have yielded new results in decreasing fuel consumption and increasing reliability. In the flow-field calculations for the return-flow zone in both the cold and hot states, we provided computational formulas for the flow field in the return-flow zone behind various types of flame stabilizers in the cold state, a method of calculating the corresponding field in the hot state that uses a simple combustion model, and a method for calculating the expansion angle of a wide-angle flame. We solved the problem of calculating the combustion products of hydrocarbons at chemical equilibrium and their thermodynamic characteristics, obtaining useful data.

#### Research on Cooling Techniques for High-Temperature Turbine Blades

Since the middle 1970's we have carried out a series of studies on cooling techniques for high-temperature turbine blades, including basic research on

modeling pulsed cooling of turbine blades, pulsed cooling with multiple rows of round jet holes, local pulsed heat exchange characteristics with round jet holes along the inside of a half-cylinder with and without a gas film, and combined pulse and film cooling, which have yielded some gratifying progress. Some results are already beginning to be used in engine design modifications. At the Seventh International Heat Transfer Conference (IHTC) we presented a paper entitled "Experimental Study of the Effect of Single- and Triple-Row Jets on Pulsed Heat Exchange Characteristics of a Half-Cylindrical Cavity," which was well received by the conference participants. We are now preparing for thorough basic research into certain new cooling methods.

#### Structural Strength and Vibration Research

To determine the fatigue life of turbine blades under certain actual loading conditions, we used the YZD-2 automatic fatigue test control device, designed by us, to automate turbine blade fatigue tests with constant-amplitude fixed-frequency tracking. This not only improved the accuracy of experimental results, but also decreased the time and physical effort required of experimental personnel. We are currently writing the relevant computer software on the basis of actual flying load spectra in order to carry out laboratory experiments on cumulative blade fatigue dynamics under controlled load conditions, which will yield P-S-N characteristics and fatigue lifetimes under actual load conditions. In addition, we have conducted research on the use of blade simulation experiments to determine true P-S-N characteristics. Progress has also been made in using acceleration fatigue theory for rapid estimation of blade lifetimes and the remaining lifetime of old blades.

Because stressed housings are subjected to complex forces, there are certain difficulties in their structural design. In order to solve this problem, we conducted studies of the strength and rigidity of stressed housings under complex loading. We used theoretical computations and experiments to determine the stress distribution on housings and investigated the heat and stress fields and the high-temperature creep and low-cycle fatigue lifetime prediction of perforated rectangular boards under one-directional pulsed tensile loads, obtaining rather good results.

To solve the problem of the matching of rotor bearing and rotor characteristics, we used the subsystem impedance analysis method to study the matching of dynamic characteristics between rotors and elastically damped bearings; we proposed the use of the "transfer matrix-impedance coupling" method to analyze the dynamic characteristics of rotor systems and established the characteristic relationship between the rotor subsystem's critical speed and bearing impedance.

In recent engines, blade vibration characteristics are greatly influenced by disk rigidity and damping; importance should therefore be attached to studying coupled disk vibration. We used an advanced finite-element technique to develop a set of computational methods and formulas applicable to the intrinsic characteristics of disk assemblies and proposed modal experiment principles and testing methods; we used the multipoint induced vibration technique and the hammer blow technique to measure the vibrational characteristics of disk assemblies. We carried out tests and measurements on

a certain compressor disk assembly, obtaining satisfying results. By analyzing typical components, we gained a preliminary understanding of the laws of coupled vibration of disks, providing data for decreasing disk vibration and for troubleshooting.

#### Research on Power Plant Control Technology

Power plant performance is strongly dependent on control system characteristics. The application of control theory, the choice of a control approach, the choice of control methods and the characteristics of control components all have a major effect on control techniques. Modern control theory, electronics technology and microcomputer technology, as well as hydraulic and pneumatic transmission technology, must be combined and applied to control systems in order to improve their technical characteristics. In recent years we have conducted research on the applications of optimal control theory in aeronautical power plant control; by setting up numerical models of the controlled systems we have obtained "formula packages" suited to optimal control, which we have used to study deterministic and random optimal control under various circumstances; we have also achieved maximum-speed control of digital computer-stepping motor systems and have achieved time optimum and carried out  $u^*(t)$  control, as well as combining electromechanical stepping systems and regulators into semiphysical models for bench-type modeling experiments, which have yielded a body of experimental data.

In the field of helicopter turboshaft engines we studied numerical models of single, double and triple speed [fa 4099] transmission systems, and the results are already being used in calculating the characteristics of certain helicopters. In order to investigate the mechanisms of qixin [3086 1800] pump impeller flow fields and methods of performing calculations on them, we carried out experimental studies and theoretical calculations with a pump test bench that we fabricated, obtaining some helpful results which will help in further research and design calculations on these pumps.

#### Areas of Expanded Research

In order to make full use of the academy's scientific and technical capabilities in support of economic development, in recent years we have gradually developed new research topics related to civilian blowers and pumps, comprehensive utilization and conservation of thermal power, measurement and automation of thermodynamic processes, combustion of heavy oil and coal powder, and the applications of microcomputers in production and experimentation; some of these products are already yielding preliminary results.

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## AIRFOIL DESIGN AT SONIC VELOCITY

Mianyang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4 No 1, Mar 86 pp 1-10

[English abstract of article by Ling Baoyu [0407 1405 3768] of Nanchang Aircraft Company]

[Text] A numerical finite difference method for calculating a hodograph solution at free-stream Mach number 1 is described in this paper. The exact hodograph formulation is used in the calculation.

Because of the singularity of the far field boundary condition in the physical plane, which is mapped to a singular point on the hodograph plane, the approximate analytical solution of the Tricomi equation is employed in the paper.

The boundary curves of five examples for the numerical calculation in the hodograph plane are described by the spline method. A family of airfoil shapes and their pressure distribution, drag, lift and moment about the leading edge are presented. These sonic airfoil designs may be useful in assessing the near sonic aircraft performance.

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## NUMERICAL MODELING OF COMBUSTOR RECIRCULATION FLOWFIELD

Mianyang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4  
No 1, Mar 86 pp 31-36

[English abstract of article by Zhao Lie [6932 3525] of the Institute of  
Mechanics, Chinese Academy of Sciences]

[Text] The present study is concerned with a fluid dynamic research task of interest to the combustor designer. A number of different types of recirculation regions are observed in combustors. In this paper, numerical computations have been undertaken for variant recirculation flowfields.

The purpose of this paper is to investigate the flowfields around the bluff-body flame stabilizer and the conditions under which the parallel jets in the same direction generate centerline recirculation.

A universal program which is suitable for simulating many configurations of combustors is formulated. One of the characteristics is a stair-step boundary representation of the stabilizer sidewall. Primitive variables of pressure and velocity are used. Turbulence simulation is by way of a two-equation k-E model.

Computational results show the interesting effects of combustor design parameters. Available experimental data provide confirmatory comparisons. The universality of the program is further confirmed.

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THE CALCULATION OF VERTICAL CONSTANT-SPEED WATER ENTRY CAVITY OF FLAT-NOSED BODY USING MAC-METHOD

Mianyang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4 No 1, Mar 86 pp 47-55

[English abstract of article by Chen Jiuxi [7115 0046 6932] and Yan Kai [7346 7030] of China Ship Scientific Research Center]

[Text] This paper attempts to simulate numerically the complete process of the development of the water-entry cavity using the MAC-method. The Navier-Stokes equation is solved by means of the finite difference method and the water surface and cavity shape are determined by the so-called marker particles, making it unnecessary to assume the cavity shape a priori. The kinematic and dynamic conditions on free surfaces are satisfied easily. The development process of the cavity, including separation, open cavity phase, deep closure and jets after closure, is shown in figures. The pressure distribution and drag coefficient are also included.

AN IMPROVEMENT OF THE NUMERICAL METHOD FOR CALCULATING AIRCRAFT CONFIGURATION  
LONGITUDINAL AERODYNAMIC CHARACTERISTICS

Mianyang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4  
No 1, Mar 86 pp 56-64

[English abstract of article by Jiang Zhenglu [5592 2973 4389] of the China  
Aerodynamic Research and Development Center]

[Text] Based on the subsonic and supersonic potential theory, an improved numerical method is developed for calculating the surface pressure distribution on the aircraft and then the force and moment by integrating the pressure distributions, using surface distribution finite elementary solutions. With the joint flow field and effective section thrust concepts and the strip turbulent boundary layer theory, an improved drag calculation can be obtained. A computer program has been developed. Several examples of calculated aerodynamic characteristics are presented and good agreement between calculation results and experiment data can be achieved.

# CALCULATION OF TRANSONIC VISCOUS FLOWS OVER AN ARBITRARY AIRFOIL

Miayang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4 No 1, Mar 86 pp 81-87

[English abstract of article by Zhang Huiliu [1728 1979 6448] of Nanjing Aeronautical Institute]

[Text] A new method for computing the inviscid-viscous interaction of transonic flows is presented.

The potential flow is computed by using the conservative full potential equations and a fast algorithm. The flow field around the airfoil is transformed into the inside of the unit circle by conformal mapping in which the FFT technique is used. The boundary layer equations are solved by using the C-S box method which has high accuracy and stability. The turbulence flow is described by a simple vortex-eddy model.

The calculation procedure of inviscid-viscous interaction of transonic flow is as follows: the potential flow is computed using the method stated above. At the same time, the velocity distribution on the surface of the airfoil is gained, which is the outer edge velocity for computing the boundary layer. Then the boundary layer equations are solved and the distribution of the displaced thickness is obtained. This procedure is repeated until the algorithm is convergent.

Two transonic flow fields are calculated using this method. The agreement between calculated and experimental results is quite good. We predict that this method will be applied to practical designs.

# INVESTIGATING SIMILARITY IN TURBULENT JETS BY LDA

Mianyang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4  
No 1, Mar 86 pp 108-115

[English abstract of article by Jiang Zhengxing [1203 2973 5887] and Lin Qixun [2651 0366 0530] of Northwestern Polytechnical University]

[Text] In this paper, a proof of the existence of the similarity in simple round and coaxial jets is given not only for nondimensional mean velocity, but also for turbulence. The similarity of simple or coaxial turbulent jets is of importance to the semi-empirical integral calculation and in theoretical or numerical computation concerning complex turbulent jets, and to the choice of the corresponding turbulent model and initial conditions. The above-mentioned proof is based on experimental investigation and analysis of mean velocity and turbulent profiles in simple round or coaxial free jets and these profiles were all obtained from DISA 55X two-dimensional Laser Doppler Anemometry (LDA).

We have arrived at the following conclusions:

1. LDA can be used to investigate the similarity of isobaric compressible and incompressible jets. In supersonic jets with shock waves, it is difficult to measure the flow field immediately following the shock wave due to the restriction of the instruments.
2. For isobaric incompressible jets, both the distribution of the mean velocity and the root mean square of turbulence can be similar if they were conducted according to the rule proposed in the paper.
3. The similarity curve of mean velocity and the root mean square of turbulence are insensitive to the thickness of nozzle lips and the  $Re$  number.

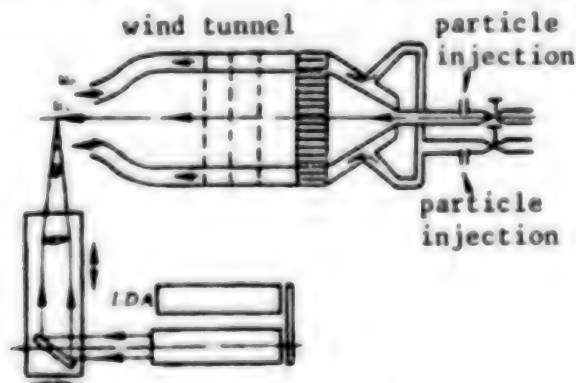


Fig. 1. Experimental Set-up

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Computers

MANAGEMENT PROBLEMS IN SOFTWARE TESTING

Chongqing JISUANJI KEXUE [COMPUTER SCIENCE] in Chinese No 4, 23 Aug 85 pp 51-54

[Article by Zhou Zhiying [0719 0037 5391] and Liu Aiwu [0491 1947 2976] of Department of Computer Sciences, Qinghua University]

[Abstract] As presented in the paper, software testing management is an important factor affecting test persistent time and test cost. By referring to the statistical number in executing the MSST software system, the paper describes its effects on testing by management, thus detailing the importance and avenues for improvement in managing software testing. In the authors' view, testing methods should be studied in order to prescribe test standards and an acceptable level of test management quality. In addition, testing tools are needed to help in implementing means of management. The MSST is composed of four independent programs: command interpretative routine TDBC of the test data library, management program TDBD of the test data library, program EXEC for module operation control and report form output, and program TDC for test data output. A table shows 11,000 statements in 226 modules for these 4 programs. Altogether 7 months of testing were involved; the statistics in the paper pertain to the last 3 months, including both testing and debugging. Four other tables list data of repeated testing (and statistics) in the last 3 months, the user situation of part of the test data, and preparation of a drive program for module testing.

# IMPLEMENTATION OF FACILITIES FOR MODULARIZED LANGUAGE PROCEDURE

Chongqing JISUANJI KEXUE [COMPUTER SCIENCE] in Chinese No 4, 23 Aug 85 pp 55-59

[Article by Zhang Xinger [1728 1630 0348], Nanjing University]

[Abstract] Currently, modularization is a developmental trend in program language design. The paper presents the XCY-2, an improved version of XCY, language. Due to limitations of the traditional implementation language, a method for implementing the procedure utility of modularization language is presented. New problems in implementation can be solved. In addition, by introducing the concept of the psuedo-index register for direct transmission of graphic and real parameters, not requiring an intermediate transitional data zone in the traditional implementation method, simplicity and high effectiveness can follow thereby saving internal storage space. Compilation includes features of correct, strict checking on the correlation of graphic and real parameters. The approach for direct transmission of graphic and real parameters by introducing a pseudo-index register is apparently adaptable to the ordinary nonmodularization language and various simpler situations. Three figures show the compilation of procedure statements, transmission of graphic and real parameters, and the relationship between the procedure data vector and designation attribute nomenclature. The author is grateful to Professor Xu Jiafu [1776 1367 4395] for his revision.

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CSO: 4009/1040

## NEW TYPE OF RESONATOR—SPHERICAL RESONANT CAVITY, BASIC CHARACTERISTICS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 97-103

[English abstract of article by Qian Shixiong [6929 1102 7160] of the Department of Physics, Fudan University, Shanghai]

[Text] This paper presents a new type of resonator--a spherical resonant cavity, which consists of a spheric medium and its interface with the surrounding medium. The intrinsic modes, mode frequencies and the internal field of this spherical cavity are discussed. It is pointed out that this kind of cavity can be used as a good optical resonator. Finally, the spectrum and angular distribution of elastic scattering from the spherical droplet are given.

# SOME OPERATING CHARACTERISTICS OF COLLIDING PULSE MODE-LOCKED Nd:YAG LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 104-109

[English abstract of article by Sheng Guoping [4141 0948 1627], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] We have conducted detailed experimental studies of a colliding pulse mode-locked Nd:YAG laser. The operating characteristics of the laser under different conditions of position, thickness, concentration of saturable absorber and pumping energy are given. Mode-locked light pulses with duration of 11-12 ps can routinely be obtained from this laser.

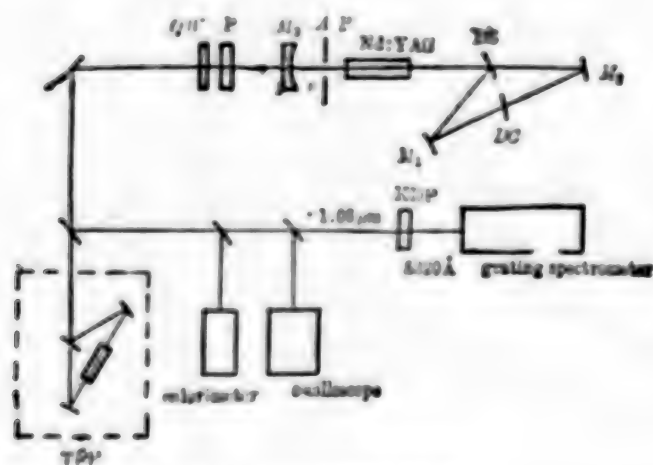


Fig. 1 Experimental set-up

## ACTIVE MODE-LOCKED Cu VAPOR LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 110-113

[English abstract of article by Zhang Guiyan [1728 2710 3601], Tang Jinrong [3282 6855 2837] and Lin Fucheng [2651 4395 2052] of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A acousto-optic modulator is used for active mode-locking in a discharge-heated CuCl laser. The modulation depth of 100 percent and the pulse-width of 2 ns are obtained. The laser repetition frequency is 16 kHz and the probability of mode-locking is about 100 percent.



Fig. 1 Schematic of the laser cavity



# DESIGN METHOD FOR VARIABLE-WIGGLER FEL WITH GRADIENT AXIAL MAGNETIC FIELD

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 114-121

[English abstract of article by Chen Jianwen [7115 1696 2429] of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The analytic expression for the bunching potential was derived according to Lorentz equations and the requirement that the force be equal to the minus gradient of the potential. The energy transfer between a relativistic electron and the radiation field is equivalent to the electron energy variation in this space potential well, and the maximum energy lost by the electron in this potential well is proportional to the depth of the well. In order to increase the energy transfer efficiency, it is required that the potential well be as deep as possible and, at the same time, the electron be kept synchronous with the potential well. These are the principles for designing FEL. The calculation results showed:

(1) The axial magnetic field should decrease exponentially along the electron propagation direction, i.e.,  $B_{//}(z) = B_{//}(0)\exp(-Kz)$ , where

$K = \frac{|e|\hbar}{\gamma_0 mc} A_w K_w r_0^2$ ;  $m$ ,  $e$  and  $c$  are electron static mass, electron charge and light velocity respectively;  $\gamma_0$  is a relativistic parameter;  $A_w$  and  $K_w$  are wiggler amplitude and wave number, respectively; and  $\gamma_0$  is the average electron Larmor radius.

(2) In contrast to the axial magnetic field, the wiggler field should increase, i.e.

$$A_w(z) = \lambda \frac{[\lambda + A_w(0)]e^{2\lambda z} - [\lambda - A_w(0)]}{[\lambda + A_w(0)]e^{2\lambda z} + [\lambda - A_w(0)]},$$

where:  $\lambda = \frac{|e|\hbar}{\gamma_0 mc} K_w^2 r_0$ ,  $\lambda_0 = [r_0 B_r(0)]^2 + [A_w(0)]^2$ .

When the conditions mentioned above are satisfied, the FEL can operate better.

# DOUBLE FILTERING FOR MAPPING PHASE OBJECTS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 122-128

[English abstract of article by Liu Liren [0491 4539 0086] of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A new method, double filtering with two filter masks, is proposed to perform the Fourier-transform quasi-interferometry. In this way, some complex filter functions can be synthesized in a Moire equivalence from two comparatively simple filter functions. Furthermore, the resultant filter function can be continuously changed by moving the masks along the optical axis, thus producing remarkable flexibility in practical applications.

# STUDY OF $(F_2^+)^*$ CENTERS IN $NaF:Mg^{2+}$ CRYSTALS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 149-154

[English abstract of article by Yu Yizhong [0060 1942 0112], et al., of the  
Department of Physics, Tianjin University; and Li Hao [2621 3185] of the  
Technical Physics Research Institute, Tianjin]

[Text] An experimental study of  $(F_2^+)^*$  centers in  $NaF:Mg^{2+}$  crystals is  
reported in this paper. The process of type transfer from  $F_2^+$  to  $(F_2^+)^*$  centers  
was observed in our experiment. The rate of transfer depends on the type of  
doped divalent metal ions rather than the concentration of doped cations.  
It was also found that the products of thermal bleaching of the  $(F_2^+)^*$  center  
exhibit the same properties as those of  $Z_4$  centers. Based on the results of  
the experiments, we propose a possible model in which the  $(F_2^+)^*$  center is  
formed by connecting a  $F_2^+$  center to an I-V pair.

ENERGY LEVELS AND SPECTROSCOPIC CHARACTERISTICS OF  $\text{Cr}^{3+}$  in  $\text{Y}_3\text{Ga}_5\text{O}_{12}$  CRYSTAL\*

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 155-161

[English abstract of article by Tang Honggao [3282 3183 7559], et al., of  
Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The energy levels and spectroscopic characteristics of the  $\text{Y}_3\text{Ga}_5\text{O}_{12}:\text{Cr}^{3+}$  crystal grown by the flux method are reported. At room temperature, the effective fluorescence lifetime of  ${}^4\text{T}_2$  and  ${}^2\text{E}$  levels was measured to be 205  $\mu\text{s}$  with the central wavelength of the fluorescence spectrum being 727 nm. The crystal-field energy levels were calculated according to the Tanabe-Sugano theory. The crystal field strength parameter  $D_q$ , racah parameters B and C, and parameter  $\Delta$  were calculated to be 1626, 645, 2950 and 538  $\text{cm}^{-1}$ , respectively.

\* Project supported by the Science Fund of the Chinese Academy of Sciences.

## CS<sub>2</sub> MULTIPHOTON IONIZATION MASS SPECTRA INDUCED BY XeCl LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 2, Feb 86  
pp 162-168

[English abstract of article by Guan Yifu [7070 0001 1133], et al., of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] CS<sub>2</sub> multiphoton ionization (MPI) mass spectra induced by a XeCl laser are reported. The dependence of ion intensity on laser intensity and sample pressure is measured. Based on the experimental results and some calculations, the MPI model of CS<sub>2</sub> and the forming pathways of ions are described.

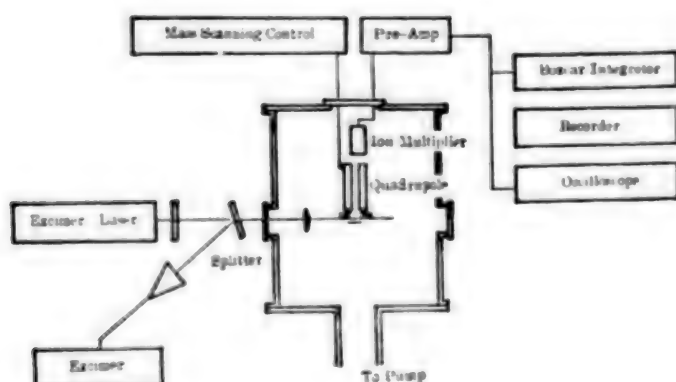


Fig. 1 Schematic diagram of MPI mass spectrum experiment

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AN INTERFERENCE METHOD FOR PATTERN RECOGNITION

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 3, Mar 86  
pp 193-198

[English abstract of article by Lu Zhenwu [4151 2182 2976], et al., of  
Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] In this paper, an interference method for pattern recognition is proposed. A test pattern may be compared with a reference pattern by overlapping the two transparent patterns with a lateral displacement in a coherent beam. If the two patterns are sufficiently similar, regular parallel fringes will modulate the common Fraunhofer diffraction pattern of the two samples being compared. The regularity of the interference fringes is a measure of the similarity between the two patterns. The effect of even a small relative rotation, however, will severely limit the region of regularity of the fringe patterns.

## THEORETICAL CALCULATION OF POLARIZATION MODULATED TWO-PHOTON SPECTROSCOPY

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 3, Mar 86  
pp 212-219

[English abstract of article by Cai Jiguang [5591 4949 0342], Xia Huirong [1115 1979 2837] and Zheng Yishan [6774 0001 0810] of the Department of Physics, East China Normal University]

[Text] Based on the density matrix equations with 3-j symbol expression, we calculate the intensities and lineshapes of fluorescence signals for two-photon transitions between homonuclear diatomic molecular singlet electronic states which have a near-resonant intermediate enhancing level. Calculations have been made for interactions between a variety of polarization modulated laser fields with three level systems. Signals obtained by the phase-sensitive detection method show that either the circular polarization modulated two-photon spectroscopy (CPMTPS) or the linear polarization modulated method (LPMTPS) could be used to eliminate the Doppler broadening background caused by the adsorption of two photons from one beam. In addition, these methods could be used to identify the specific branches of the two-photon lines from their irregular spectral structures without the need of knowing the upper level constants. Signal ratios of equal-frequency two-photon transitions under circular polarization modulation conditions to those with linear polarization modulation have been listed for all branches with  $\Delta J = \pm 2, \pm 1$  and 0. Differences in the results might be orders of magnitude for a reasonably large  $J$  value. On the other hand, signal ratios of two-photon branches in the intensity modulated circular polarization laser field to those in linear polarization fields (shown in another list) are all in the same order. In addition, a table is presented to show the relative signal intensities of unequal-frequency polarization modulated two-photon transitions between various electronic states. This might be useful in determining intermediate or upper electronic states of a resolved two-photon absorption line. PMTPS is thus expected to be a useful method for molecular spectroscopy or high-resolution laser spectroscopy.

## QUANTUM BEAT IN RESONANCE FLUORESCENCE

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 3, Mar 86  
pp 220-226

[English abstract of article by Liu Liang [2692 2733], et al., of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The fluorescence intensity of a two-level atom system driven by a two-monochromatic field has been calculated. The results show that the intensity oscillates with time in the long-time limit and the oscillation is the superposition of a series of harmonic waves. The case for maximum oscillation amplitude modulation is reached when one near-resonant monochromatic field acts with an atom, while the difference in frequency of the two monochromatic fields is equal to the Rabi frequency for the first monochromatic field. We call this phenomenon quantum beat in resonance fluorescence.

PRELIMINARY RESEARCH OF CONTACT PHOTOLITHOGRAPHY BY USING A UV EXCIMER LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 3, Mar 86  
pp 274-276

[English abstract of article by Lou Qihong [2869 4388 3163], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] Excimer lasers are noted primarily for their ability to produce high output powers at ultraviolet wavelengths. This ability has made them attractive for lithography application. Excimer lasers are many times more powerful than conventional deep-ultraviolet sources, like xenon mercury lamps.

An experiment of contact photolithography in the order of a micrometer was demonstrated by using an ultraviolet XeCl excimer laser. An X-ray preionized discharge pumped xenonchloride laser was used to expose a thin layer of resist. The laser, which emits at 308 nm, delivered 10 MW of peak power in a  $2 \times 2 \text{ cm}^2$  beam. A chromeon-quartz mask, with features ranging from  $1.0 \sim 10 \text{ }\mu\text{m}$ , was employed for contact photolithography.

After optimization of the laser power intensity on the resist, the best laser power intensity for contact photolithography was found to be about  $0.2 \text{ J/cm}^2$  under our experimental conditions. The pattern on the resist shows that linewidths down to  $1.5 \text{ }\mu\text{m}$  can be resolved, and  $2.5 \text{ }\mu\text{m}$  lines can meet the requirements of LSI.

This technique has great implications for photolithography because it has high resolutions and ultra-fast exposure times.

# REAL-TIME VIBRATION MEASUREMENT BY IMAGE HOLOGRAPHY AND PHOTODETECTION

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 3, Mar 86  
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[Text] A system for real-time measurement of vibration using image holography and photodetection is described in this paper. This system can be used to measure samples having rough surfaces with poor reflectance. The photo-detection instrument required here is very simple. Some examples of the measurement are given.

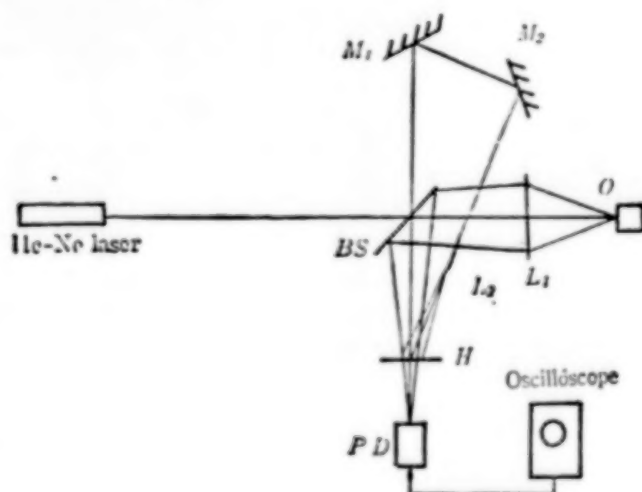


Fig. 1 Configuration of the measurement system

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